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PROGRESSIVE DEVELOPMENT OF RESOURCES IN THE LAKE SUPERIOR REGION*

BY

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PHYSIOGRAPHIC FEATURES. The Lake Superior region as here discussed includes over 180,000 square miles in Wisconsin, Michigan, and Minnesota, in the United States, and Ontario, in Canada. This area is shown in Fig. 1.

The area includes parts of three topographic provinces: (a) the Lake Superior Highlands, (b) the Lake Superior Basin and (c) the Belted Plain of portions of Wisconsin, Michigan, and Minnesota. The Lake Superior Highlands are part of a more extensive peneplain which truncates Archean and Algonkian igneous, sedimentary, and metamorphic rocks.

The west part of Lake Superior Basin is a rift valley, produced by *graben* faulting in this peneplain, the remainder of the basin being of undetermined origin.

The Belted Plain consists of alternating cuesta uplands with intervening lowlands, in one of which Lake Michigan lies. These are in the Paleozoic sediments, while in part of the Minnesota area the plain lies on Cretaceous sediments.

The region has been nearly all glaciated, but a small portion in the southwest lies in the Driftless Area. It, therefore, has residual

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soils derived from the underlying sandstone, limestone, and igneous and metamorphic rocks.

Another small portion of the area is overlaid by the older drift, its soils being somewhat weathered, transported soils. These two regions are essentially without lakes and have respectively normal, mature drainage and partly-readjusted young drainage.

A third subdivision of the area, comprising the major portion, is covered with the ground moraine, terminal and recessional moraines, drumlins, etc., of the latest (Wisconsin) glaciation, the ice of which came partly from the Labrador and partly from the Keewatin center. Its soils are all transported and are little decomposed. In many places they are stony, sandy, and infertile, although there are large exceptions. Its drainage is youthful and not at all adjusted to the rock structures. Rapids and falls, and lakes and swamps, or muskegs, are most abundant.

The fourth subdivision is the region of lake deposits, especially the clays, silts, and sand laid down in the large marginal glacial lakes, including glacial Lakes Nemadji, Duluth, Chicago, Algonquin, and Nipissing in the Lake Superior and Lake Michigan basins and glacial Lake Agassiz in the valley of the Red River of the North. Here the soils are also transported but they vary greatly in fertility from the somewhat undesirable stiff red clay of parts of the Lake Superior and Lake Michigan borders to the rich silts of the floor of Lake Agassiz in the northwest corner of the area.

The Lake Superior region has an average mean annual temperature of about 45°, 10° to 20° for January and 65° to 75° for July. The annual rainfall is 29 to 34 inches. The climate is affected by the Great Lakes, somewhat modifying a continental climate in the belt of prevailing westerly winds.

Geographical Relations. At present the Lake Superior region constitutes a peninsula of partial wilderness, projecting into adjacent agricultural lands. At first only those resources were developed which were easily removable and were in demand in the neighboring regions. The physiographic influence upon the development of the region has gone hand in hand with historical progress. The furs were thus first sought, then the forests and fish, then the copper and iron ore. All these are associated with stages in the history of the exploration and settlement of America. The utilization of the Great Lakes in relation to resources outside as well as within the area, has been a factor of great importance, as in the case of grain. Agriculture and manufactures are still in early development in the Lake Superior region.

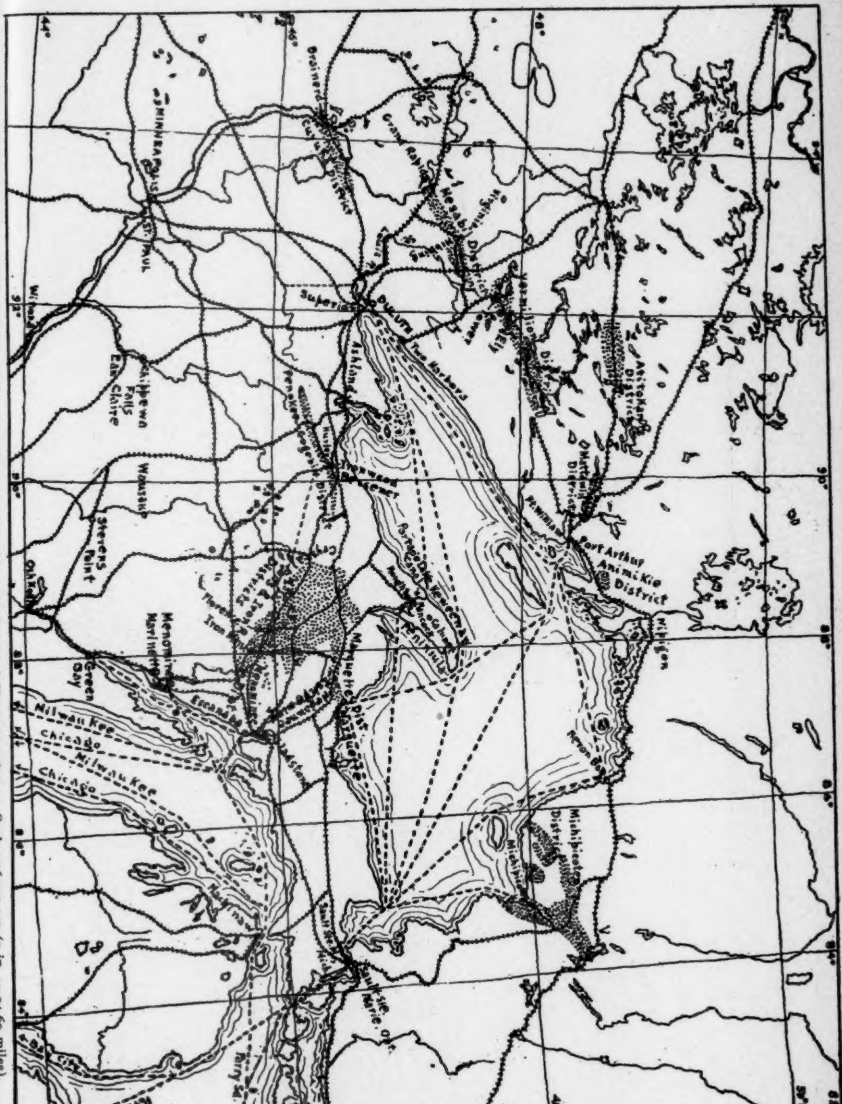

FIG. 1—Sketch Map of the Lake Superior Region showing Iron Districts and Lines of Transportation. Scale 1:6,000,000 (1 in. = 94.69 miles). [Iron districts based on U. S. G. S. Monographs 19, 28, 36, 43, 45, 46; railroad lines on U. S. G. S. base-map of U. S., 1:2,500,000, and on base-map of Canada, 1:2,217,600; transportation routes on Great Lakes on Lake Survey Charts. Compiled by W. L. G. J.]

THE CONTROLLING FACTORS. Of the geographical factors influencing the development of the Lake Superior region none are more notable than its natural resources and its routes of trade. Of these natural resources the iron and copper ores are among the most important, but they are not the only ones, the timber which formerly covered the region having produced millions of dollars worth of lumber, while the land itself has enormous agricultural possibilities, as, for example, on the western border of the region where wheat is raised and flour milled the shipment of which from Lake Superior through the Soo is greater in value than that of the iron ore, though with only one-eleventh the tonnage of the ore. In most areas close to Lake Superior the wheat-raising industry is entirely undeveloped.

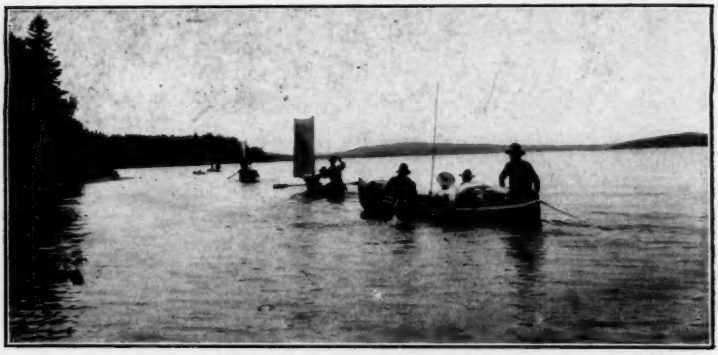

FIG. 2—Lake near Nipigon, Canada. A party starting on a long trip through a chain of lakes and streams produced by glaciation.

Among routes of trade the Great Lakes naturally rank first, but the other waterways and the rather low relief of the whole region, through which railroad building has been comparatively easy, are also important factors, as will be seen later.

INFLUENCE OF GLACIATION. One notable geological factor is the fairly recent covering of the region by a great continental ice sheet. The glacier, it is true, had its detrimental features, especially in the removal of certain of the soft ores, as in the Mesabi Range, and in covering many regions, especially the iron ranges, with a great thickness of glacial drift. This covering is well illustrated on the Mesabi and various other ranges where the ore is removed by steam shovels after stripping the glacial soil covering it. At many mines the drift is so thick as to entail a considerable expense for removal. In the newest of the iron ranges, the Cuyuna Range of

Minnesota, the drift is so thick that open-pit work is impossible and underground mining is necessary, adding considerably to the expense of operating the low-grade ores. More than this, the very heavy drift, covering this and other ranges, is responsible for the obscuring of outcrops and for the necessity for great numbers of test pits or diamond drill holes or magnetic surveys to determine the location of the iron-formation rocks.

These detrimental features are partly compensated by advantages also resulting from the glaciation of the region. Some of these ad-

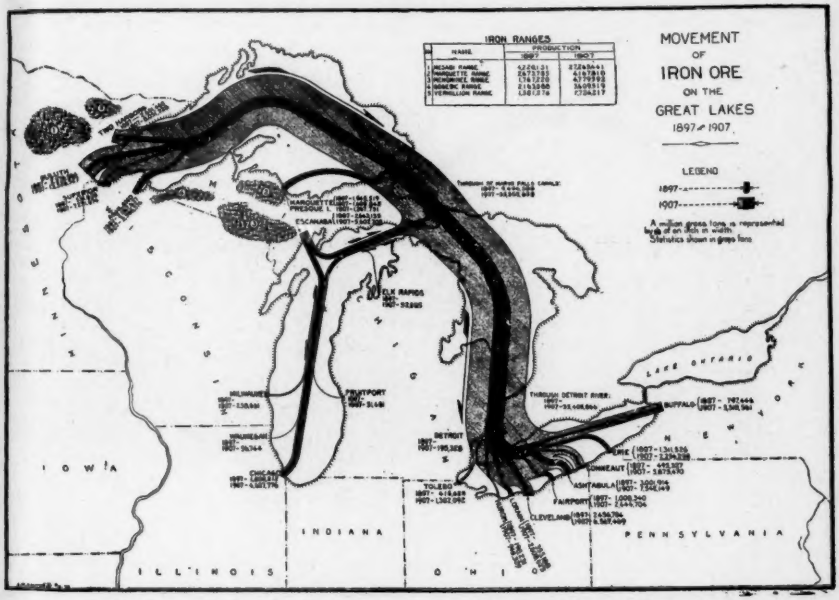

FIG. 3—Increase in Iron Ore Shipments, 1897–1907. (After Commissioner of Corporations.)

vantages are (a) the removal of what must have been a heavy mantle of soil of residual decay on certain of the iron ranges, thus making prospecting for the ores much easier in some districts because of the abundance of outcrops; (b) the development of the new drainage features which did not exist before the glacial period. The prospector for iron ore and the geologist can well appreciate what the difficulties of exploration in the Lake Superior region would have been had not the country been covered with a net-work of lakes and sluggish streams, separated by rapids and short portages, making it possible to travel for great distances by canoe (Fig. 2). Not one of

the Great Lakes, except possibly Lake Superior, existed before the glacial advance, and the region had not a single one of the tens of thousands of small lakes with which it is covered. In the respect then of a highway being provided over which it was easy to travel and explore, and transport ore, lumber, coal, grain, flour, etc., the glacial invasion was distinctly beneficial.

INFLUENCE OF HARBORS. An enormous tonnage of iron ore is carried eastward over Lake Superior and the other Great Lakes (Fig. 3). Coal and other materials are carried to the iron and

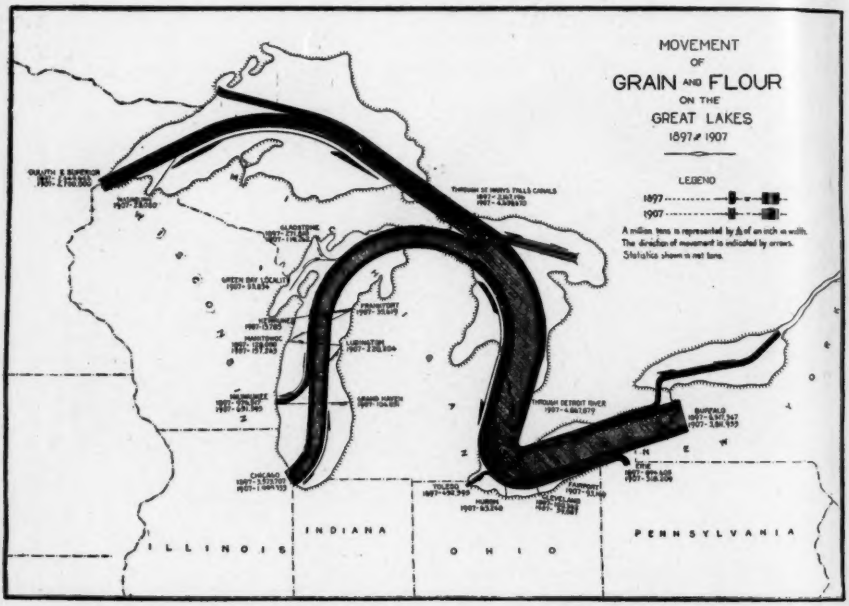

FIG. 4—Increase in Grain and Flour Shipments, 1897–1907. (After Commissioner of Corporations.)

copper country. Naturally, the Great Lakes themselves are far the most important geographical asset in this transportation. A second asset of great value, however, is the series of good harbors which make it possible to load the ore and grain boats with comparative ease and safety. If it were not for the submergence of certain old river valleys, which are thus made into protected landing and loading places, such harbors would not have been available. The harbors at Escanaba, Marquette, and Ashland in Michigan, at Fort William and Port Arthur in Canada and at Two Harbors, Minn. (Fig. 1), have been improved at a comparatively slight expense, so that they

are excellent places for the loading of vessels. The harbor of the Bay of Superior,—at Duluth and Superior,—is one of the best of these ports, furnishing a safe place for loading ore, grain, and lumber and unloading coal, etc., a Haven in time of storms, and a winter refuge for numerous vessels. This harbor exists because the lake waters have been canted into the valley of the St. Louis River, which is even more protected by the building of two sand sits at the head of the lake.

Fort William and Port Arthur, on Thunder Bay, are harbors of importance; Duluth and Superior are also busy ports. From the former two Canadian ports hardly any iron ore is transported at the present time, but grain and flour are shipped eastward from them over the Great Lakes route. The Great Lakes are thus seen to be of importance, a commercial asset in an entirely different industry

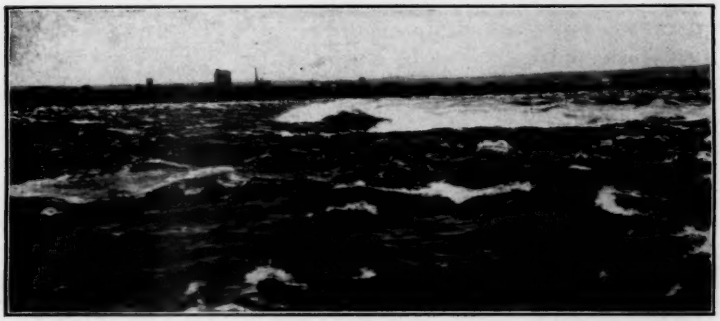

FIG. 5—The Rapids at the Soo. Sault Ste. Marie, Canada, in the background.

(Fig. 4). The shipping from Fort William and Port Arthur, which was a little over half that from Duluth and Superior in wheat, other grain, and flour in 1906, surpassed these American ports in 1907 in both wheat and other grains, though not equalling Duluth and Superior in flour shipments. This is due to the increased development of the Canadian Northwest. Most of this grain from Lake Superior ports goes to Buffalo and by the Erie Canal and railways to the Atlantic Coast. Some, however, goes by the Welland and St. Lawrence canals to the Canadian seaboard.

INFLUENCE OF SAULT CANALS. Still another factor in the development of this great trade route from Lake Superior to the other Great Lakes and to the Atlantic, is the original connection of all the Upper Great Lakes except Superior by navigable waterways. Lake Superior iteslf is separated from this great chain of highways by

a navigable river with a short rapid at Sault Ste. Marie (St. Marys Falls, Fig. 5). The descent from Lake Superior to the level of Lake Michigan and Huron is about twenty feet, and the length of the rapids is only about a mile. Accordingly, it was possible to construct a short canal, with locks, at Sault Ste. Marie (the Soo), which would take the vessels past this obstacle. In the infancy of transportation on the Great Lakes, it was necessary to unload the vessels at the Soo, and to reload vessels on the other side.

The Hudson's Bay Company built the first canal, which was on the Canadian side, in 1798. It admitted only batteaux and canoes. The efforts to induce the American government to build a canal at this point were at first unsuccessful, largely through the opposition of Henry Clay, it is said, who could think of no resources of the Lake Superior region the transportation of which would ever warrant the enormous expense of the canal.

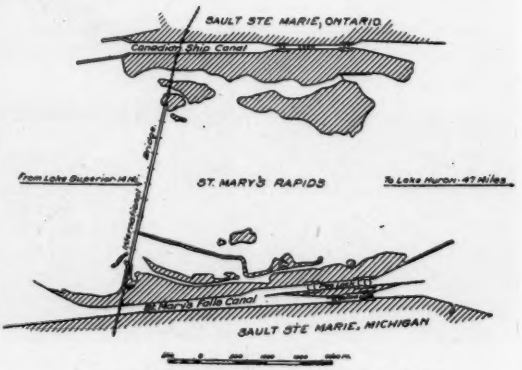

FIG. 6—The Rapids, Canals and Locks at the Soo.

The State of Michigan undertook the building of the first ship canal* as early as 1837, although the canal was not completed until 1855, because of lack of support by the national government. It cost $1,000,000.

The American government started to rebuild this canal and lock in 1869, completing the work in 1881. A second lock (Fig. 6) was started in 1887 and completed in 1896. The cost of these two locks and improving the canal and river was $10,000,000. The Canadian canal and lock were built between 1892 and 1894 at a cost of $4,000,000. The construction of still another and longer lock is said to be contemplated on the American side.

The increase of traffic through the Soo is indicated by the fact that these three new locks (two in the United States and one in

* This and many other statistics on the Sault Ste. Marie canals are from the annual report of the Chief of Engineers of the United States Army; the Blue Book of American Shipping, 13th Annual Report, 1908, 423; and from an article by E. E. Ferguson, *Bull. Amer. Bureau of Geogr.*, II, 1901, 74–88.

Canada) have already been necessary since the first one, while the increase in the size of vessels is shown by the relative dimensions of the various locks:

	LENGTH.	WIDTH.	DEPTH.
Two Michigan Locks, each....	250 ft.	70 ft.	11½ ft.
Weitzel Lock.....	515	60	17
Poe Lock.....	800	100	22
Canadian Lock.....	900	60	22

THE SAULT CANALS AND THE DEVELOPMENT OF LAKE SUPERIOR IRON MINING. This increase in the size of the canals is partly due to the increasing wheat shipments, but almost entirely to the iron ore transportation, due to the wonderfully rapid increase in iron mining in the Lake Superior region. The vessels have increased to a length of 605 feet,* 60 foot beam, depth of 32 feet and a capacity of 13,000 and even 14,000 tons. Sailing vessels are fast going out of the lake traffic. They carried 30 per cent. of the tonnage at the Soo in 1895, 15 per cent. in 1905.

With the increased saving in time of loading iron ore (a cargo of 9,277 tons has been loaded at Duluth, for example, in 70 minutes) and of unloading (10,346 tons being unloaded at Cleveland in 4 hours and 10 minutes) and the saving of delay in the Soo locks (normally the only place of delay in the whole route), it is possible for one boat to make many trips from the head of the lakes or from other ore ports to the Lake Erie ports in a season. This is why several large and fast-working locks are necessary. It was estimated that the five days' delay incidental to the sinking of a vessel in the St. Marys River below the canal in 1900, holding back only the vessels drawing over 13 feet, resulted in a loss of $500,000 to the various operators of vessels. With delays eliminated, many and fast trips can be made. The *W. E. Corey* made thirty trips from Duluth to the Lake Erie ports in 1906, carrying 302,000 tons of iron ore. The more trips made the cheaper the rate of transportation. In 1907 the rate varied from seventy-five cents (Duluth to Lake Erie ports) to seventy cents from Marquette and sixty cents from Escanaba, which is much less (about one-fifth) than the minimum railway rate or the rate if vessels had to be unloaded and loaded again at the Soo. Contrast this with one and eight-tenths cents a bushel, the 1907 rate on wheat, which is bulkier but not so heavy, from Duluth to Buffalo, by lake, and with the rate on coal, the only bulky commodity going west (Fig. 7), on which the rate from Lake Erie ports to Duluth, by lake, was only thirty cents per ton in 1907.

The cost of the Soo canals, even without tolls, is paid over and

* The Atlantic liner "Lusitania" is 785 feet long.

over again in this cheapness of transportation. The expenditures involved in their building have been more than warranted by the enormous traffic which goes through the canals at Sault Ste. Marie. Although the season for lake transportation is limited to less than eight months, the canals at Sault Ste. Marie carry a greater tonnage than any other canals or other waterways in the world, surpassing even the Suez Canal, which has been and is still the great route of trade between Europe and Asia and is open the year round, as is the Kiel, or Kaiser Wilhelm, Canal between the Baltic and North

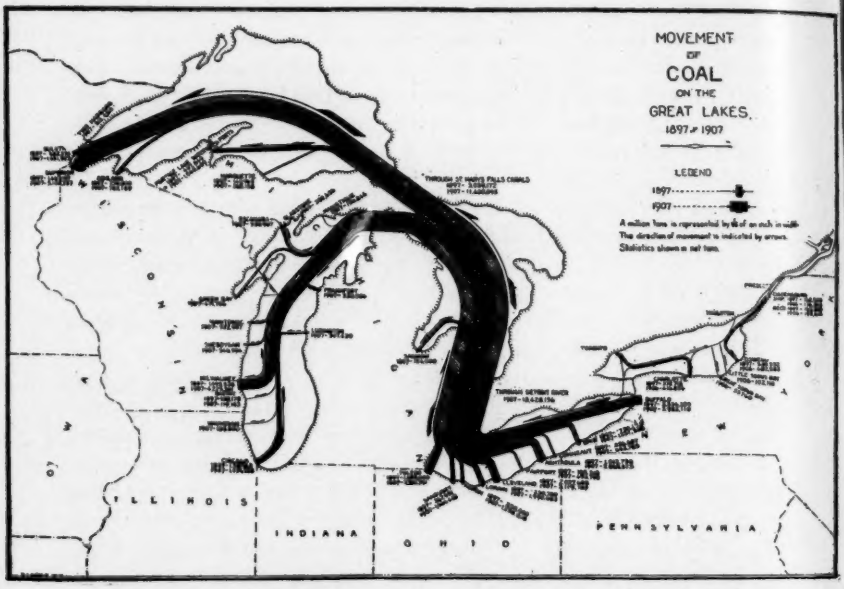

FIG. 7—Increase in Coal Shipments, 1897–1907. (After Commissioner of Corporations.)

Seas in Germany. The net tonnage at the Soo* was three times that of the Suez Canal in 1906 and seven times that of the Kiel Canal. It increased between 1906 and 1907 by a tonnage nearly equal to the combined tonnage of the Suez and Kiel Canals in 1906, as the following table shows:

	SOO.	SUEZ.	KIEL.
1895	16,806,781 tons net	8,448,383 tons net	(not open)
1900	22,315,834 " "	9,738,152 " "	3,488,767 tons net
1905	36,617,699 " "	13,132,694 " "	5,270,477 " "
1906	41,098,324 " "	13,443,392 " "	5,796,949 " "
1907	58,217,214 " "	.....	.....

* Transportation by Water, United States, 1906, Bureau of the Census, *Bull.* 91, 1908, p. 46.

This comparison of the traffic at the Soo, Suez and Kiel Canals shows a large yearly increase in the case of the Soo Canals. This is related partly to the great growth of production of wheat farther west, both in United States and Canada, but mainly to the increase in the iron production (24 per cent. 1903-1905) largely in the region tributary to Lake Superior (and not including Lake Michigan) and especially on the Mesabi Range (which had five-fold increase of tonnage shipped, 1902-1905). These figures give no account of the shipments by the Great Lakes from the Menominee and Crystal Falls districts, whose chief ports are Escanaba and Gladstone (Fig. 1), and whose vessels do not pass through the Soo canals.

The traffic past Detroit, which would include this and other Lake Michigan and Lake Huron traffic, amounted in 1906 to over 70,000,000 tons, carried in 25,000 vessels. This includes a season of 230 days and a different proportion of west-bound as well as east-bound traffic, for example, part of the commerce of Chicago.

The greater part of the iron ore is carried in vessels belonging to the iron and steel companies which own or operate many of the mines. In 1906 the United States Steel Corporation (Pittsburg Steamship Company) had 101 vessels with 368,165 aggregate gross tonnage, 16 per cent. of the total gross tonnage of the Great Lakes.* The Gilchrist Transportation Company had 62 vessels with 190,890 tons gross register. The latter are not allied directly to any of the iron or steel interests, as are the various other steamship operators who handle ore and coal. The package freight service, carrying goods readily transferred from cars to boats, are practically all owned or run in connection with the great trunk line railways like the Pennsylvania Railroad, the New York Central, the Canadian Pacific Railway, etc.

The freight tonnage carried through the Soo canals in 1888, 1890, 1895, 1900, 1906 and 1907 follows, comparative analytical figures for 1900 and 1907 being given for the sake of showing the preponderance of the iron ore traffic and its great increase. The other products shipped are of notable bulk and value and show large increases as well, except the yearly fluctuations of grain, and the diminution in lumber shipments. They come nowhere near the iron ore traffic in tonnage,† the iron ore making 89 per cent. of

* From statistics by Walter Thayer, "Transportation on the Great Lakes," in American Waterways, *Annuals Amer. Acad. Polit. and Soc. Science*, XXXI, 1908, 126-138.

† 1900 figures quoted from *Bull. Amer. Bureau of Geogr.*, II, 1901, 87-88; 1907 figures and general data for 1888-1906 from Monthly Summary of the Internal Commerce of the United States, December, 1907, Bureau of Statistics, Department of Commerce and Labor, 1908, 631-632; and from Transportation by Water, 1906, United States, *Bull* 91, Bureau of Census, 1908, 46.

the east-bound traffic by tonnage. The west-bound traffic is not quite a quarter of the east-bound, ninety per cent. of it being coal.

1855.....	—— vessels,	carrying	14,503 tons	worth	$ ——
1880.....	3,503 "	"	1,244,279 "	"	——
1888.....	7,803 "	"	6,411,423 "	"	82,156,019
1890.....	10,557 "	"	9,041,213 "	"	102,214,948
1895.....	17,956 "	"	15,062,580 "	"	159,575,129
1900.....	19,452 "	"	25,643,073 "	"	267,041,959
1906.....	22,155 "	"	51,751,080 "	"	537,463,454
1907.....	20,437 "	"	58,217,214 "	"	569,830,188

(16,475 vessels in 1906 by the United States canal and locks,
5,680 " " " " " Canadian " " lock.)

Tonnage shipped via Soo canal 1855–1895: 101,244,462 tons.
" " " " " 1895–1907: 427,148,680 "

Total shipments via Sault Ste. Marie, 1855–1907, 528,393,142 tons.

Total iron ore shipments, 1854–1907, except Menominee (*i.e.*, practically ore shipment via Soo), 464,751,429 tons; iron ore 81 per cent. of total Soo tonnage.

	1900		1907	
Eastbound:	TONS.		TONS.	
Iron Ore	16,443,568	.....	39,594,944	
Pig Iron	....	.....	20,406	
Copper	131,066	.....	89,959	
Wheat	....	(40,489,302 bu.)	....	(98,135,775 bu.)
Other grain	....	(16,064,225 bu.)	....	(43,461,186 bu.)
Flour	....	(6,754,876 bbls.)	....	(6,524,520 bbls.)
Lumber	....	(909,651,000 feet)	....	(649,320,000 feet.)
Building stone	48,902	.....	898	
General Merchandise	....	.....	106,075	
Passengers	....	.....	....	(31,710 persons)
Total Eastbound Freight	....	.....	45,544,319	
Westbound:				
Hard Coal } Soft Coal }	4,486,977	.....	1,506,668 / 9,893,427	
Manufactured Iron	....		287,535	
Flour	....	.....	....	(250 bbls.)
Grain	....	.....	....	(2,152 bu.)
Salt	....	.....	....	(460,802 bbls.)
General Merchandise	....	.....	916,579	
Passengers	....	.....	....	(31,048 persons)
Total Westbound Freight	....	.....	12,672,895	
Total freight tonnage	25,643,073 tons	.....	58,217,214 tons.	

The proportional value of the products carried through the Soo canals in 1906, was:

	VALUATION.		PER CENT. OF TOTAL VALUATION.
Iron ore	$121,981,795	Iron ore	23 1/5%
Wheat, other grain and flour	133,281,196	Cereals	24 3/5%
Copper	36,595,220	Copper	6 4/5%
Coal	25,136,044	Coal	4 3/5%
Lumber	19,813,882	Lumber	3 3/5%
Manufactured iron, pig iron, salt, and building stone	30,427,667	Mfg'd iron, etc	5 3/5%
Unclassified	170,227,650	Unclassified	31 3/5%

(To be concluded.)

A REVIEW OF THE WATERWAY PROBLEM

BY

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The agitaton of waterways has been so persistent during the last few years, so much has been said and published and so many phases of the question have been disclosed, that our national waterway problem is in danger of being embarrassed, not by too much data, but by too many opinions. It is well for the findings of the numerous committees to be presented, apart from formal reports, and to this end a review of the following recently published documents on our waterways is undertaken:

A. Preliminary Report of the Inland Waterways Commission. Government Printing Office. 1908.

B. Report of the Commissioner of Corporations on Transportation by Water in the United States. 3 volumes. Government Printing Office. 1909.

C. Report by a Special Board of Engineers on Survey of Mississippi River. Government Printing Office. 1909.

D. Report of the Mississippi River Commission. Government Printing Office. 1909.

E. Transportation by Water. Census Bureau. Government Printing Office. 1908.

F. Report of the National Conservation Commission. Government Printing Office. 1909.

G. Preliminary Report of the United States National Waterways Commission. Government Printing Office. 1910.

For over twenty years our waterways, and especially the Mississippi courses, have shown a constantly decreasing volume of trade. On the other hand, the reports of the railroads of the country have detailed an enormous increase of traffic, so much, in fact, that our railroads in times of bountiful production have not been equal to the demands of the areas which they serve. At St. Louis, the total amount of freight in tons received from railroads during 1908 was 23,577,922, and from the river 293,180, or a little more than one per cent. of the importation was by river lines (C. 351). The city is entered by twenty-nine lines of railroads, directly or indirectly, and it is the converging point of a river system that spreads over the whole interior basin of the United States. Antwerp, Belgium, on the other hand, receives twice as much freight from the waterways as from railroads. New Orleans, with a population of 290,000 and

situated 106 miles from open water, compared with the ports of Hamburg, with a population of 850,000 and located 160 miles from the sea, and Antwerp, with a population of 400,000 and 55 miles from the sea, makes a poor showing for a waterway town. The entrances to these ports are practically alike by means of a 26-foot waterway of ample width. New Orleans' export and import trade amounted, during 1908, to 3,500,000 tons, of which 1,400,000 tons were in coal from up the river; Hamburg imported goods to the amount of 11,000,000 tons, and Antwerp imported over 9,400,000 tons; the American city sent less than five per cent. of the total tonnage of trade (160,000) tons up the valley, the German city sent seventy-three per cent. (8,000,000) tons of the import up the Elbe, and the Belgian city, eighty per cent. (7,500,000 tons) of its imports up the Scheldt (C. 350). Hamburg has in the hinterland 7,500 miles of rivers and canals of less than eight feet depth, Antwerp has 1,200 less than ten feet, while there is a possible 13,000 miles of waterway open to navigation down to six feet, at various degrees of efficiency, inland from New Orleans.

It is necessary to warn readers that German and Belgian trade statistics are not fairly comparable with those of the southern part of the United States. Many circumstances make quite different conditions. The geographic location of New Orleans is not favorable for trade. It is somewhat apart from the great traffic lines, while Antwerp and Hamburg are in part termini of the heaviest freight traffic highway in the world. Again, New Orleans does not have a dense population in the inland region abutting the rivers. The area (29,620 square miles) adjoining the Mississippi River from St. Louis to New Orleans has about 2,046,000 inhabitants, which makes a population of 76 per square mile including the cities, or about 38 per square mile outside of the cities, and the seven States adjoining the lower Mississippi has a density of population of 46, which rather sparse population gives little opportunity for local commerce. Belgium has a density of population of 620, and Germany of 290. The seven Mississippi River States, Illinois, Missouri, Kentucky, Tennessee, Arkansas, Mississippi and Louisiana, together have about one-fourth the total population, seven-fourths the area, one-seventh the density and eight-sevenths the total railroad mileage of Germany alone (C. 324). In the third place, the United States is largely developed by railroads. This is in part the result of the extensive domain which contains areas of great productivity, separated from each other by rather long journeys. Moreover, many areas of this country comparable in possibilities with the densely populated re-

gions of Europe, contain a comparatively sparse population. Thus the southeastern portion of the United States if "settled like the New England State of Massachusetts, would contain 40,000,000 of people; if like Saxony, it would hold 20,000,000 more than the present total population of the United States; area for area it has resources of all kinds several times greater than those of Saxony."

The development of the United States by railroads is also in part due to the topography of the United States, which, unlike European countries, has no dominant natural central or longitudinal strategic vantage ground, but is somewhat separated in diverse physiographic provinces. New England's manufacturing plants have been located far from the raw materials, the major part of the food of the operatives is brought from a distance, the coal for warmth and power comes from without its borders and, in general, rapid and persistent transportation is necessary in order to maintain the standard of its output. Certainly, if the demand for rapid transit obtains in a country of tremendous magnitude and in a land where manufacturing plants are established and highly developed in scattered and somewhat in topographically remote places, there can be no great development of transportation by water. The great basins of our large rivers are not the most highly populated regions of the United States as they are in other regions of the world, and this in any waterway consideration is a vital point. In years to come, the alluvial basin of the Mississippi River may support a dense population and then the development of the waterway will be a natural and easily obtainable project; until then there must, to some degree, be given to the steamship companies the assurance of protective measures. If we eliminate, in considering European waterways, the factors which represent a difference mostly of historical status, and which stand to-day as a difference of density of population, of stability of population, of habits of trade, of priority in highway rights, and of relationship between railways and waterways, there will be found some encouragement for the future of our own waterways development.

The decline in the Mississippi River traffic in twenty years has been large. The official figures give for the Upper Mississippi a decline of 71.9 per cent.; the Ohio, 3.6 per cent., and the Lower Mississippi, 59.1 per cent. At St. Louis, the water shipments fell from a total of 600,000 tons in 1890 to 89,000 tons in 1906, while the railroad shipments increased from 5,000,000 tons in 1890 to 17,000,000 tons in 1906 (B, II, XXIII). Instance after instance may be specified. There is no doubt about the fact of the decline, consequently the discussion to-day accepts it and turns to the proposals of rem-

edies. The result of all this investigation is an increasing interest in waterways generally and in the specific problem of the Mississippi. The unbiased presentation of the causes of the decline in traffic is necessary in order to know where to apply the remedial agents. These causes lie probably about as follows:

1. In the river itself.
   A. The unreliability of the depth of water.
2. In the nature of the carrier.
   B. The river boats have not improved in fifty years.
   C. The terminals and systems of unloading and loading have not improved.
3. In the character of the commerce.
   D. It is restricted to the movement of freight between river points only.
   E. It is necessary to transship goods.
4. In the competition.
   F. Railroads are allowed to compete with river lines and at times their methods are questionable.
   G. River lines have burdens of insurance, wharfage charges, and the like to sustain.

A. The unreliability of the river.

The cry for a 14-foot channel along the Mississippi River, connecting the Great Lakes with the Gulf, arose in 1902, and has persisted. The Report of the Special Board of Engineers should in a great degree silence this demand and aid us in turning our energies towards more suitable projects. The Board investigated seven methods, all of them possible, of maintaining a 14-foot channel and estimated the amount of work necessary to be done, the first cost and the annual cost of operating and maintaining the plant.

These methods are by dredging, regularization, canalization with movable dams, canalization with fixed dams, lateral canals, reservoirs and a combination of methods. Only two of these are considered here.

1. Reservoirs. This system for improving the Mississippi River has strong advocates and as strong opponents. The discussion on the merits and failures of this plan has been at times heated. Reservoirs for the impounding of the excess of water during flood time and for supplying the low stages with enough water for navigation were advocated early in the history of the improvement of the river. Throughout all the discussion, opposition to reservoirs has been strong

enough to prevent much experimentation along this line. There has been established, however, north of St. Paul on the Mississippi River a system of five reservoirs covering, in total, 480 square miles. While the original recommendation included more reservoirs in this system, it has been impossible to obtain the requisite appropriation from Congress. The Board, after an examination of the effects of this system of reservoirs, which they state is the largest system of artificial reservoirs in the world, does not believe that any extension of its application to the Mississippi River below St. Louis will be attended with any approach to the desired result, and furthermore, that the cost of installing the system would be incommensurate with the benefits to be derived. The arguments against the reservoirs are:

a. With reservoirs at the headwaters of the tributaries, it would be impossible to forecast the time of discharge in order to benefit the low water stage. The effect of a flow from the above system cannot be felt in St. Louis within a two-month interval after the discharge begins. This interval is too long in a river where the drop in stage is neither regular in time nor in degree.

b. The storage reservoirs of the International Waterways Commission on the various tributaries have a capacity of 540 billion cubit feet. Arguing from the effects of the Mississippi system, the Board concludes that the "rise of the river bed indicates that the maximum of 540 billion cubit feet total storage, which might be obtained by reservoirs in the Mississippi River Basin from the Illinois River upward, could not maintain throughout the year more than eight feet available depth between St. Louis and Cairo, the increased discharge from the reservoirs tending to create a wider channel rather than a deeper one, and being useful, therefore, only as an auxiliary to other methods of improvements. To hold the water stage at St. Louis at 22 feet, the stage corresponding to a controlling depth of 14 feet between St. Louis and Cairo, would require over 5,000 billion cubic feet annual storage, or about ten times what has yet been found possible." This is practically the attitude of the Mississippi River Commission.

Before the days of the Mississippi River Commission, Ellet proposed a series of reservoirs for the tributaries of the Ohio to impound enough water, not only to reduce the flood height, but also to supply water during the low water stages. Leighton's scheme* does not differ in kind from Ellet's. In the plan before us to-day, 100 reservoirs with an enormous capacity and with a much broader distribution are provided. The objections made to Ellet's plans were in the

*W. A. Dupuy. Handling the Rivers of the Nation. *World's Work*. March, 1908. 10011.

main in two lines, that the reservoirs would have to be located on valuable sites and that the effective handling of the impounded waters would be an almost impossible task. Leighton's plan must also be open to the same objection, but the salve has been administered for the great financial outlay by a promise of great dividends from the water power. "A purely nominal rental would be ample enough to repay in two or three decades the entire original expense of the system, besides a good income on the investment." Enthusiasts for reservoirs see all the ills that rivers are heir to cured by this system. "The proper building of reservoirs in the headwaters, therefore, offers what no other plan can possibly offer: it promises effective regulation of river stages and water supply for all time to come, removing entirely the liability of destructive floods, checking the erosion of banks and preventing much of the formation and shifting of sand bars and the pollution of water which the presence of sediment means."*

2. The Board commits itself to the recommendation of the continuation of the works of partial regularization of the stretch of the river from St. Louis to Cairo which will yield an eight-foot channel and then to obtain the fourteen feet by dredging; and south of Cairo, of the protection of the existing banks and of dredging. This is largely the policy of the Mississippi River Commission to-day. The recommendations of these two commissions could not be expected to vary in any degree, inasmuch as three out of five members of the Board are also members of the Commission.

The Board's most reasonable recommendation, however, is the abandonment of the fourteen-foot waterway project on the ground that all the commerce of the valley, present and prospective, can be adequately carried by a nine-foot channel. In commenting on this report Congressman Kunsterman of Wisconsin detailed the situation on European rivers with the text "that over in Europe the boats are made to conform to the existing river channels, while here we want to dig channels to conform to the needs of deep-draft ships."† The same speech contained the statement that the Rhine, with an average depth of six feet, carries an annual tonnage of twenty million; the Elbe, with a four and one-half foot average, eight and one-half million, and the Volga, with an eight-foot average, carries fourteen million. This recommendation against the fourteen-foot waterway is, perhaps, the most important turn which has occurred to our waterway affairs during the last few years. The survey for

* W. S. Tower. The Mississippi River Problem. *Pop. Sci. Monthly*. LXXIII, 26 July, 1908.
† *Cong. Record*, 61st Congress, 2nd Session. 45, 2019.

a fourteen-foot waterway was provided for by the River and Harbor Act of June, 1902, from the mouth of the Illinois River, via the Mississippi, to St. Louis, in connection with a fourteen-foot waterway from Lockport, Ill., to St. Louis. Such a waterway between the Lakes and the Gulf would have been a burden, and the outlay for construction and maintenance unnecessary. The Secretary of the Mississippi Valley Transportation Company, in a recent speech, describes the boats which that company has designed for the Mississippi River. The boats are 350 feet long, 50 feet wide and 10 feet deep in the hull; they will float in fifteen inches of water; 600 tons gives them a draft of three feet; 1,200, four feet; 2,200, six feet, and 4,000, nine feet. A thirty-inch navigable depth on the Oder River in Germany sustains three and one-half millions tons of freight annually. Large boats of the coastwise pattern or Lake type could not navigate the tortuous course of the river, even if these would float in a fourteen-foot channel. The idea of seagoing vessels sailing from Chicago via the Mississippi River is preposterous.

The Mississippi River Commission has been remarkably successful in maintaining a nine-foot channel south of Cairo. During the low water season of 1908 (E. 2646), under the stress of an unusually low stage of long duration, considerable effort was required to keep the crossing open. A number of the crossings had less than the required depth before the arrival of the dredges. At one crossing there was only six feet of water, but this was increased easily to nine feet. Four other sections were recorded with a depth from seven to eight feet. It is fair to add that three dredges were withdrawn from the regular service during the season to perform experimental dredging under another project. The river during the low water stages has been in very good condition for navigation, and the unreliability of previous years has to a large degree disappeared, but the river cannot be said to be entirely trustworthy. The sense of uncertainty has been kept alive by the departures from the stage of nine feet set by the Commission as a minimum.

B. The river boats have not improved in fifty years. The flat bottom stern-wheeler is and has been the prevailing type of steamboat on the Mississippi (E. 171). These in 1906 comprised 69 per cent. of the number and 74 per cent. of the gross tonnage of steam vessels. About six per cent. of the number with a gross tonnage of nineteen per cent. were side wheelers, which were employed in freight and passenger and ferry service. Less than one per cent. in number and in tonnage were center wheelers used for ferry service, and twenty-five per cent. were of the screw propeller

class, but these carried only six per cent. of the total tonnage. Much local traffic is carried by gasoline boats under fifteen tons which are not subject to official inspection. In addition to self-propelled boats, there are many barges used as bulk carriers. These unrigged craft constitute on the Mississippi system 85 per cent. of the total number of vessels and 96 per cent. of the total vessel tonnage. Most of these are engaged in the coal trade on the Ohio.

While there has been a betterment in the bulk carriers, which is largely limited to coal and the gradual displacement of the old wooden barges by steel ones is now going on, and while, perhaps, the stern-wheeler is the best sort of vessel for the river, the service, especially of the packet boats for freight and passengers, has been far from satisfactory. Certainly, the peddling of freight and passengers will not mean a large business: it is far different from being a regular carrier of the products of great industries. In the former case the load is accidental; in the latter traffic is sure and regular. "Freight cannot be carried by railroads in the main-line business in mixed trains which stop to pick up their cargo at the depot platform. How absurd it would be if the Pennsylvania Railroad should announce in the papers of the day that they would receive freight at the Union Depot, and that a train would come through about 4 o'clock and stop there while the freight was trucked aboard; and if they should add to this announcement the fact that this train would take passengers for New York! It sounds laughable, but it is no more laughable than any one of the announcements in the papers of New Orleans, Memphis, Vicksburg or St. Louis, or any one of a hundred other cities, every day of the year, that the magnificent new steamboat Centurion will receive freight and passengers to depart at 4 o'clock at the levee to-day, for Greenville and the Bends, or wherever she may be headed for."*

C. The terminals and systems of loading and unloading have not improved. The landing on the Mississippi River is a location near an undercut bank, where the vessel can be forced near enough to the shore for a gangway to be lowered. This means has a certain advantage from the standpoint of expense, unless the amount of goods be large, but it is very profligate of expense if a through boat attempts to stop at all the landings. In the case of a purely local traffic between farms and plantations, no odium can be attached to it. The reports of the numerous boards which have investigated the traffic of the Mississippi state that the terminals at the larger river ports are in a backward state. In general, the indictment is that, at

* American Forestry. XV, p. 34.

many points, there has been but little improvement of the natural banks and, at many more points, there has been a dearth of mechanical devices for handling freight, and at some points, owing to the variations of the stage of the river, floating freight sheds are used from which the freight is laboriously dragged up the levee (B. III, 202). The lack of loading and unloading facilities increases the cost of operating when the tonnage is large, by increasing the size of the crews, consequently Mississippi River steamboat crews are larger than those of the coastwise and lake traffic (E. 177). For the coastwise service, the average is one man for every 42 tons of gross tonnage; for the Lakes, the average is one man for every 107 tons, while on the Mississippi River it is one man for every 8 tons. In contrast with all other traffic, the coal traffic of the river system ought to be considered. Coal, sand and stone constitute 86.9 per cent. of all the barge freight of the river (E. 183), and these commodities on specific rivers, as the Ohio, form 91.6 per cent., and the lower Mississippi 46.5 per cent. At the Port of Pittsburg coal constituted 75 per cent. of the total commerce; at New Orleans, about 1,200,000 tons of coal is received by river shipments. There has been an important increase in the coal traffic, especially of the Monongahela River. This coal traffic is largely owing to the enterprise of the Monongahela River Consolidated Coal and Coke Company. The terminals of this company are similar to all great port terminals, and are in strong contrast to the terminals used generally on the river. This comparison leads a Congressman, in consideration of the River and Harbor Bill, to say "that with proper equipment for river navigation we can do as well and better (than in Europe) in the United States is evident from the fact that coal is shipped from Pittsburg to New Orleans in barges of eight feet draft at three hundred and seventy-six one-thousandths of a cent per ton mile—a little over one-third of a cent per ton mile. The average ocean freight in ships of 21-foot draft is thirty-five one-hundredths of a cent per ton mile—just a trifle less than that shipped on barges on the Mississippi. Now, what enables the coal companies to ship coal on the Ohio and Mississippi Rivers at such low rates? Simply the fact that they have proper terminals and proper machinery to load and unload their coal at a minimum cost. I doubt whether the cost of transportation would be lessened the least part of a cent if the 14-foot project were carried out and barges of 12-foot draft, instead of 8 feet, be used. Certainly not a sufficient deduction in transportation would result to warrant the great expenditure of a 14-foot channel."*

* *Cong. Record* 45. 2019.

The rights of the water-fronts in the various cities of the valley are variously distributed, but in general they are to a large degree out of the public control. Thus Pittsburg has a river front of 30 miles; of this six and one-fourth miles are owned by the city, railroads own ten and five-eighths, and the railroads and industrial concerns occupy all the Ohio and Monongahela frontage except two and one-half miles. Cairo has six and one-half miles of river front; the city owns none; railroad lines occupy the frontage on both the Mississippi and Ohio Rivers, except a length of about twenty blocks. Memphis owns its entire frontage of five miles, but a part of the frontage is occupied by tracks (B. III, 228).

D. Freight is restricted to movement between river points only. The river line is to a large degree fixed in direction. It may or may not trend in the path of the greatest commercial activity; it may or may not connect areas yielding raw materials with areas of manufacturing advantages; areas yielding food products with areas of dense population; or regions of great industrial output with regions that might be a market. River lines, on the other hand, generally connect the interior with the coast, and this, in a country of limited area, is more apt to be the line of trade than in a country of wide expanse. Large cities are sometimes developed by railroads in locations apart from the waterways, and some of the cities, like Worcester, Mass., and Birmingham, Ala., are industrial and manufacturing centers of no small magnitude. In the history of transportation, canals and waterways preceded railroads. In densely settled countries, as Germany, where the resources are largely known, the location of waterways are in line of permanent trade, and because water transportation is cheaper than rail, these water routes have persisted and have been eminently successful. In a newer country, like the United States, where the center of population has been gradually shifting and where the line of great industrial movement has not become constant, waterways cannot have a development comparable with the railroads. This topic is further expanded under the following heading:

E. Transhipment is necessary. Two points are considered here: the impossibility of ocean or lake vessels using a river channel and the possibility of the use of waterways for a part of a long distance haul because of cheaper rates.

The type of vessel for lake or ocean traffic must necessarily be different from the type best adapted to river traffic. The storms to which the former are subjected increases the cost of building so that an ocean vessel costs about $71 for each ton carried; on the

Lakes, where storms are less violent, $41.50, while a tugboat and ten barges capable of transporting 10,000 tons of freight on an eight and one-half foot draft cost about $12 (C. 24). Besides the item of expense there is the question of limits of navigability due to the irregular course of a river highway and to the depth. It would never pay to straighten the river for ocean craft and, as it is, the long and narrow ocean and lake type could not navigate the bends with the rudder power only sufficient for open sailing. A fourteen-foot waterway would not yield depth enough for ocean and lake traffic. The tendency has been towards vessels of greater draft, and it is reported that but a comparatively small portion of the steamers of ocean commerce could use a fourteen-foot harbor.

It is apparent that much of the material for river shipment in the United States comes from or is destined for points not on the river. In the case of coal from Pittsburg, the bulk carriers are loaded directly from the mines and are loaded into the holds of ocean-going vessels at New Orleans with very little handling. Coal is the largest commodity carried on the river; it is bulky freight and ought to be carried by water at a cheaper rate than by rail, and the difference in the rates should be enough to give good interest on proper methods of handling the coal at the terminals. Yet during 1906, in a table compiled from the "Mineral Resources of the United States" (B, II, 256), there is shown that 37,000,000 tons of coal were shipped to and through Pittsburg, 12,000,000 to and 25,000,000 through. Of the 12,000,000 tons, 5,000,000 came by rail and 7,000,000 by water; of the 25,000,000 tons shipped through Pittsburg, 22,500,000 went by rail and only 2,500,000 tons, or about eleven per cent., was carried by river lines. The present traffic of the system is made up largely of commodities where the necessity of transshipment is slight, and includes forty per cent. of the total traffic in coal, twenty-five per cent. in logs, fourteen per cent. in stone and sand, five per cent. in package freight, and the remainder variously distributed with less than four per cent. in agricultural products. Very little traffic is done where the river is made a means of low rates as a part way of a long distance haul; and even in large centers, as Cincinnati, the river brings but a small per cent. (33) of the coal distributed to the district.

F. Competing lines of railroads and their methods. There are certain advantages accruing to railroads which arise from the nature of the carrier. These have been stated above in the negative way from the standpoint of water traffic, and they embrace the possibility of lines being built to any site with the promise of traffic,

the great development of branch and shunt lines, the transference of products from one line to another without handling, the great development of the through-freight, and the concentration and high development of terminals at the most convenient locations. There are certain other advantages which the railroads have assumed through an unjust use of power which count against the river traffic, but which does not in the long run benefit the nation at large. These have been pointed out (G, 7) to be:

1. The power of the railroads to charge lower rates between points where there is competition by water routes and to make this up on lines devoid of competition. For example, Clarkesdale, inland, is 76.7 miles, and Friars Point, on the Mississippi River, is 70.1 miles from Memphis. The charge on first-class merchandise per hundred pounds from Clarkesdale was fifty-six cents; from Friars Point to Memphis, forty-five cents. The former town is 379 miles from New Orleans, and the latter 385,5 miles. The rate from Clarkesdale to New Orleans was seventy-two cents; from Friars Point to the same city, forty-five cents, and on the former line the charge on cotton was $2.25 per bale, on the latter, $1.00.*

It is asserted (A, 316) that while there has been a decline in the traffic of most commodities on the Mississippi River due to railroad competition, the shipment of lumber and coal has not suffered because the rate by boat is so cheap, as, for instance, coal from Pittsburg to New Orleans at a cost of less than two dollars per ton, or less than one mill per ton-mile, that the railroads cannot compete. It is quite generally the case that rates by water are lower than rates by rail, as, for instance, the rate in cents per hundred pounds from Pittsburg to Cincinnati by rail is 41 and by water 25 (A, 115). For the shipper, however, the rates are nearly equalized, because in water traffic there must be added the cost of insurance, as well as the extra charge of cartage.

2. The power of the railroads to buy steamboat lines, to force into bankruptcy competitive river lines by discriminating tariffs to monopolize wharf privileges, to block shipments by adverse placements of tracks and to run competitive lines of steamers. The extent of occupancy and ownership of water frontage on the Ohio and Mississippi rivers along the line of the greatest traffic of the system has been given for Pittsburg, Cairo and Memphis. J. C. Welliver writes (A, 388) that if the Ohio had been a German river, "The State would maintain that instead of building railroads to handle traffic which would as well be moved by river, it would

* *Cong. Record*, 41. 2,427. 1907.

better leave this traffic to the river and spend its money building railroads in regions where it was impossible to furnish any but rail transportation."

3. The power of railroads to prevent partial transportation by water by the refusal to pro-rate. There is no doubt that if the railroads and steamship lines could be made to coöperate and could be hindered from competing, our waterway transportation problem would be another story. Numerous instances may be cited. It is reported (A, 330) that the steamship lines on the Ohio had pro-rating agreements with all railroad lines approaching the river. In 1900 these arrangements were terminated by the representative of the railroads. "Instead of being able to quote through rates as formerly, the packet lines are now obliged to quote their own rate to the point where they connect with the railroad, and then add the local tariff rate of the railroad from that point to destination" (A, 331). This loss of pro-rating agreements is supposed to have resulted from the undue influence of certain large corporations, and it has ruined the water traffic in such staples as are produced by these monopolies. On the other hand, a recent decision of the International Commerce Commission (B, I, 333) seems to infer that the Commission has the power to compel railroads to pro-rate with a steamboat line.

G. The burdens of insurance, wharfage charges, etc. Marine insurance affects shipping in two ways: there is the necessity of insurance of the vessel itself which is assumed by the company and the necessity of insurance of the merchandise which is assumed by the shipper. In the former case the rate is high because of the greater liability and because at a single time a great part of a steamship company's equipment is under the stress of danger and the loss of a single vessel may mean the failure of the company. In comparison with the railroads of the United States, which, during 1906, suffered a loss of only 1.3 per cent. of the total freight revenue, so small that it is covered by the operating expenses, the steamship companies are severely handicapped. And, furthermore, because shippers are obliged to insure their own bill of goods, the companies must make lower rates than the railroads in order to attract trade; thus the cost of insurance must be added to the freight rate in order to get the exact cost of transportation. From Vicksburg to New Orleans the freight rate on cotton is seventy cents per bale and the insurance is twenty cents, making a total cost of ninety-five cents.

Besides the premiums for insurance, many boats along the river

have to pay terminal charges, such as dock rent, if the wharf is used, wharfage rent, and sometimes towage and pilotage costs. The wharfage charges are frequently so high as to discourage navigation. One river boat on the Ohio paid over $3,200 for landing charges, which was one-fourth the net profits of the boat (B, II, 35). The result is that the boats refuse to stop at certain points, and the traffic is turned over to the railroads. These charges are in the main intended to cover the cost of maintenance, but in many places the depreciation of the property is evident, and the charges approach the character of "hold-ups." When the charges for landing at public wharves equals or excels the entire amount of the freight rate received from the landing, as is frequently the case, there is no encouragement to vessel owners to receive small consignments, and package freight must disappear from the river.

The waterway problem has assumed large proportions. In the volumes reviewed there is much material not pertinent for printing in this place, but which is interesting and valuable. The question of power and water privileges from certain slack-water projects are considered at great length. That some of the recommendations contained within these volumes will be fought is indicated in the brief discussion of the Rivers and Harbors Appropriation Bill of this Sixty-first Congress, Third Session, when a member, speaking for the Lakes to the Gulf Deep Waterways Association, states that "The purpose of that convention (St. Louis) was to call the attention of Congress to the growing necessity of a 14-foot channel from the Lakes to the Gulf, and the convention went on record in its resolutions demanding that no less than 14 feet should be permitted and should be accepted,"* and caused to be read in Congress portions of these resolutions.

The subject has become an intricate one; it is pioneering into the unknown with little aid from the analogies drawn from other lands; but one can find encouragement, in the face of so much insistence from Boards of Trade and Waterway organizations, that the Committee of the Senate and House of Representatives advises that without a careful and unbiased examination of proposed improvements of the nature now required by statute no project should be adopted by Congress.

* *Cong. Record*, 46. 178. Dec. 1910.

THE DISCOVERER OF THE PHILIPPINES

BY

JOHN DENISON CHAMPLIN

It is remarkable that neither of the two great navigators who endowed Spain with her colonial possessions was a Spaniard; Columbus, who "gave to Castile and Leon a new world," was a Genoese; Magellan, the discoverer of the Philippines, was a Portuguese. Magellan, who ranks second only to Columbus as a navigator and discoverer, was actuated, in undertaking his long voyage across the Pacific, by the same motive which induced the great Genoese to brave the terrors of the "immeasurable sea of darkness," as the Arabian geographers termed the Atlantic—that of reaching the spice countries of the East by sailing westward.

The spice trade of southern Asia had long been a source of wealth to the European nations that controlled it. Under the Roman Empire the chief route of this trade was by way of the Red Sea. Once a year, in June or July, a fleet of a hundred and twenty ships sailed from Myos Hormos, a port of Egypt, for the coast of India and the island of Taprobane (Ceylon), where the merchants of the East congregated to exchange their commodities, chiefly pepper and spices, for the wines and the silver, tin and lead of the West. The fleet returned in December or January to Myos Hormos, whence the products of the voyage were transported on camels to the Nile and down that river by boat to Alexandria, then the chief distributing point for the western world.

After the rise of Islam, this trade, which in the East was wholly in the hands of the Mohammedans, sought the West through two principal channels, the ancient southern route by the Red Sea, and a northern one through the Black and Caspian Seas, and by camel-caravans beyond. After the Crusades the southern route was controlled by the Venetians, the northern one by the Genoese. The irruptions of the Tartars and the fall of Constantinople broke up the eastern trade of Genoa and reduced her to the brink of ruin. Out of her troubles arose the idea that the countries of the East could be reached by sailing westward across the Atlantic, the spice trade redeemed from Mohammedan control, and Genoa's commercial supremacy restored. Columbus, one of those who entertained this

idea, died in the belief that he had reached the Indies. But the discoveries of Columbus and his successors led to results far different from those anticipated: maritime power left the Mediteranean for the coast of the Atlantic, and Spain and Portugal succeeded to the commercial and naval greatness of Genoa and Venice.

A short month after Columbus's solemn reception at Barcelona by the Court of Spain, after his return from his first voyage, Pope Alexander VI divided the undiscovered world between Spain and Portugal. The Grand Admiral had discovered, a hundred leagues west of the Azores, a line of non-magnetic variation, where the compass-needle pointed due north without deviation, and had come to the conclusion that this line was a fixed geographical boundary between the Eastern and Western Hemispheres. The Pope changed this physical meridian into a political one by making it the line of demarcation between the possessions of the two countries, limiting Spain to lands discovered to the west of this meridian and Portugal to those east of it. By the convention of Tordesilhas, signed June 7, 1494, Spain and Portugal agreed to remove Pope Alexander's line of demarcation between their respective possessions to a meridian 370 leagues west of the Cape Verde Islands.

Twelve years after Vasco da Gama's voyage around the Cape of Good Hope had won for Portugal the trade of the Indies, the Portuguese entered the Indian Archipelago, and in 1512 an expedition sent out by Albuquerque discovered the Moluccas or Spice Islands, the chief object of the long search of both Portuguese and Spaniards. With this expedition went, perhaps, Fernando Magellan, or, in its Portuguese form, Fernan de Magalhães, a young naval officer who had accompanied Albuquerque to the Indies, though he is not mentioned by De Barros among those who took part in it. Whether he actually visited the Moluccas or not, he obtained at this time a knowledge of those islands which led afterwards to the great voyage that has won him a place among the world's famous discoverers.

Magellan returned to Portugal in 1513 and, after some service in Morocco, dissatisfied with his failure to receive the promotion which he considered his due, left the service of the King of Portugal and went to Spain, where he settled and married. The geographical position of the Moluccas was then in dispute, both Spain and Portugal claiming them as lying within its own division. In a letter written October 23, 1522, by Maximilianus Transylvanus, Secretary to the Emperor Charles V, to the Cardinal of Salzburg, we are told that Magellan "showed to Cæsar" that the "islands which they

call the Moluccas, in which all the spices are produced, and are thence exported to Malacca, lay within the Spanish western division, and that it was possible to sail there; and that spices could be brought thence to Spain more easily, and at less expense and cheaper, as they came direct from their native place." Charles, who had just been elected Emperor of the Holy Roman Empire, being a Fleming rather than a Spaniard, did not share the prejudices of his subjects against the Portuguese. He created Magellan a knight of St. James, entrusted him with a fleet of five ships to prove his claims, and advanced him a liberal sum for the maintenance of his family during his absence.

Magellan's fleet consisted of the Trinidad, the flag-ship, of 110 tons; the San Antonio of 125 tons; the Concepcion of 90 tons; the Vittoria of 85 tons, and the Santiago of 75 tons, manned by 237 men, including soldiers. Among the volunteers was Antonio Pigafetta, a native of Vicenza, Italy, who had gone to Spain in the suite of Monsignor Cheregato, Ambassador of Pope Leo X. He employed his leisure in keeping a journal of the events of the voyage, which was published after his return in an abridged form, first in French and later in Italian, but not in its entirety until 1800, when it was printed from the original manuscript in the Ambrosian Library, Milan. As Pigafetta's limited education is largely compensated by intelligent and quick perception, heightened by curiosity concerning the countries and peoples visited, his journal is intensely interesting.

The squadron set sail from San Lucar, Sept. 20, 1519, spent a week at Teneriffe, and cast anchor in the bay of Rio de Janeiro on the 13th of December. Following the coast southward in search of the inlet supposed to connect the Atlantic with the South Sea (Mar del Sur), as Balboa had named the western ocean, and after spending some time in the exploration of the Rio de la Plata, which he supposed to be that passage, Magellan reached, March 31, 1520, a harbor on the coast of Patagonia, which he named Port St. Julian, where he wintered. He suppressed there, in a summary manner characteristic of the age, a conspiracy against his life by the Spanish commanders of the ships, who hated him, says Pigafetta, because he was a Portuguese. Two were executed and their bodies quartered and set up on stakes on shore. A third, who had received his appointment directly from the Emperor, was pardoned, but was detected a few days later in a fresh conspiracy and was set ashore, together with a priest in complicity with him, and abandoned to the mercy of the Patagonian savages.

On Oct. 21, 1520, the fleet entered the strait separating the continent of America from Tierra del Fuego. It was Saint Ursula's day and Magellan, who was very religious so far as outward observance went, named the cape at its entrance in her honor the Cape of the Eleven Thousand Virgins. The strait itself was called Vittoria, after the ship which first entered it, but Magellan subsequently named it the Channel of All Saints. Later navigators, ignoring both these names, have chosen to call it after him who first navigated its waters. Some five weeks were occupied in exploring its channels, during which the Santiago was wrecked. The San Antonio soon after deserted and returned to Spain, where she arrived May 6, 1521, and spread false reports about Magellan. After a fruitless search for her, the remaining ships went on and on Nov. 28, 1520, Magellan weathered the Cape of Desire at the western entrance of the strait and entered upon the great western ocean to which he gave the name of Pacific (Oceano Pacifico), on account of the calmness of its waters as compared with the stormy Atlantic.

The hardships endured during the many days before they again saw land—a voyage more than three times as long as that of Columbus from the Canaries to Guanahani—the disheartenment of the crews reduced almost to starvation, and the indomitable energy and perseverance of Magellan, unequalled save by that of the great Genoese, are graphically narrated by Pigafetta. We "entered into the Pacific Sea, where we remained three months and twenty days without taking in provisions or other refreshments, and we only ate old biscuit reduced to powder, and full of grubs, and stinking from the dirt which the rats had made on it when eating the good biscuit, and we drank water that was yellow and stinking. We also ate the ox-hides which were under the main-yard so that the yard should not break the rigging, and they were very hard on account of the sun, rain and wind, and we left them for four or five days in the sea, and then put them a little on the embers, and so ate them; also the sawdust of wood, and rats which cost half a crown each, moreover, enough of them were not to be got."

Mistaking the position of the Moluccas, Magellan sailed northward to about the thirtieth parallel, after which he pursued a northwesterly course across the equator to about ten north latitude, when he changed his course to the west. He saw no land, excepting two sterile islets until he reached the archipelago of volcanic islands, now called the Marianas or Ladrone Islands, where he cast anchor on March 6, 1521. "The captain-general wished to touch at the largest of these islands to get refreshments of provisions; but it was

not possible because the people of these islands entered into the ships and robbed us, in such a way that it was impossible to preserve oneself from them. Whilst we were striking and lowering the sails to go ashore, they stole away with much address and diligence the small boat called the skiff, which was made fast to the poop of the captain's ship, at which he was much irritated, and went on shore with forty armed men, burned forty or fifty houses, with several small boats, and killed seven men of the island; they recovered their skiff. * * * Immediately after we sailed from that island, following our course, and those people seeing that we were going away, followed us for a league with a hundred small boats or more, and they approached our ships, showing to us fish, and feigning to give it to us. But they threw stones at us and then ran away, and in their flight they passed with their little boats between the boat which is towed at the poop and the ship going under full sail; but they did this so quickly and with such skill that it was a wonder."

Magellan, disgusted with his reception, named the group Islas de los Ladrones or Isles of Thieves. They were taken possession of for the crown of Spain, forty-four years later, by Miguel de Legaspé, the conqueror of the Philippines, and their name was changed subsequently to Marianas, in honor of Maria Anna of Austria, queen of Philip IV. They now constitute a province of the Philippines, the seat of government being at Guam, the largest island.

Ten days later, on Passion Sunday, March 16, 1521, Magellan, still in search of the Moluccas, came in sight of Samar, the most easterly of the central group of the Philippines, and was thus the first European to look upon that famous group, though they had long been known to the Malays, Javanese, Chinese and Japanese, whose ships had visited them for centuries. "In this place," writes Pigafetta, "there were many circumjacent islands, on which account we named it the Archipelago of Saint Lazarus (San Lázaro), because we stayed there on the day and feast of Saint Lazarus. This region and archipelago is in ten degrees north latitude, and a hundred and sixty-one degrees longitude from the line of demarcation." The islands retained this name until 1542, when Ruy Lopez de Villabolos, leader of an unsuccessful expedition from Mexico to colonize them, renamed them the Philippines in honor of Philip, Prince of the Asturias, who succeeded his father, the Emperor Charles V, in 1556, as Philip II. Magellan saw but little of the archipelago. Passing through the strait of Surigao, he reached, on March 28th, the little island of Limasagua, called by Pigafetta Mazzava, where he received a friendly reception by the "king" and his subjects. Thence

he sailed northwest between Leyte and Bohol, and on Sunday, April 7, entered the harbor of Çebu in the island of Çebu, the Zzubu of Pigafetta.

On approaching the principal village, Magellan ordered all his ships to hang out their flags and to fire their artillery. Having come to anchor, he sent a young man and his interpreter ashore. They found the king and a great number of people assembled, all alarmed by the artillery. The interpreter calmed their fears by telling them that the guns had been fired in honor of their king. The king, reassured, asked "what we were seeking. The interpreter answered him that his master was captain of the greatest king in the world, and that he was going by the command of the said sovereign to discover the Molucca islands. However, on account of what he had heard where he had passed, and especially from the King of Mazzava, of his country and good fame, he had wished to visit him, and also to obtain some refreshments and victuals for his merchandize. The king answered that he was welcome, but that the custom was that all ships that arrived at his country or port paid tribute, and it was only four days since that a ship called the Junk of Ciama [Siam], laden with gold and slaves, had paid him his tribute, and to verify what he said, he showed them a merchant of the said Ciama, who had remained there to trade with the gold and slaves."

The interpreter told the king that his captain would not pay tribute to any sovereign in the world; and that if he wished for peace he should have peace, and if he wished for war he should have war. The Ciama merchant then said to the king in his own language: "Look well, oh king, what you will do, for these people are of those who have conquered Calicut, Malacca, and all greater India; if you entertain them well and treat them well you will find yourself the better for it, and if ill, it will be so much the worse for you, as they have done at Calicut and Malacca. The interpreter, who had understood all this discourse, said to them that the king, his master, was a good deal more powerful in ships and by land than the king of Portugal, and declared to him that he was the King of Spain and Emperor of all Christendom, wherefore, if he would not be his friend and treat his subjects well, he would another time send against him as many men as to destroy him. Then the king answered that he would speak to his council, and give an answer the next day."

On the next day the king, assured that the Spaniards only wished to trade, "said that he was content, and as a greater sign of affection sent him [Magellan] a little of his blood from his right arm, and

wished he should do the like." A delegation from the king, consisting of his nephew and some principal men, visited the ship and were received with much ceremony, Magellan "sitting in a chair of red velvet and the principal men of the ships near him in leather chairs and the others on the ground on mats." Magellan made the visitors a long address on the subject of peace, and told them of the advantages that would accrue to them if they became Christians. His hearers seem to have been impressed by Magellan's eloquence, and answered that "they wished first to speak to their king, and then would become Christians. Each of us wept for the joy which we felt at the good-will of these people," * * * who "all cried out with one voice, that they did not wish to become Christians from fear, nor from complaisance, but of their free will."

The king having sent to Magellan a present of baskets full of rice, pigs, goats and fowls, the latter despatched Pigafetta and another with return presents—"a robe of yellow and violet silk in the fashion of a Turkish jubbeh, a red cap, very fine, and certain pieces of glass, and had all of them put in a silver dish, and two gilt glasses. When we came to the town we found the king of Zzubu at his palace, sitting on the ground on a mat made of palm, with many people about him. He was quite naked, except that he had a cloth round his middle, and a loose wrapper round his head, worked with silk by the needle. He had a very heavy chain round his neck, and two gold rings hung in his ears with precious stones. He was a small and fat man, and his face was painted with fire in different ways. He was eating on the ground on another palm mat, and was then eating tortoise eggs in two china dishes, and he had four vessels full of palm wine, which he drank with a cane pipe."

Magellan sent a quantity of merchandise on shore, with four men to dispose of it, and the king gave them a house to display it in. "These people live with justice, and good weight and measure, loving peace, and are people who love ease and pleasure. They have wooden scales for weighing their merchandise. Their houses are made of wood and beams and canes, founded on piles, and are very high, and must be entered by means of ladders; their rooms are like ours, and underneath they keep their cattle, such as pigs, goats and fowls."

The king having finally promised to become a Christian, great preparations were made for the baptismal ceremony. A scaffolding was erected in the open space of the village, and decorated with tapestry and palm branches. "On Sunday morning, the fourteenth day of April, we went on shore, forty men, of whom two were

armed, who marched before us, following the standard of our king emperor. When we landed, the ships discharged all their artillery, and from fear of it the people ran away in all directions. The captain and the king embraced one another, and then joyously we went near the scaffolding, where the captain and the king sat on two chairs, one covered with red, the other with violet velvet. The principal men sat on cushions, and others on mats, after the fashion of the country. Then the captain began to speak to the king through the interpreter to incite him to the faith of Jesus Christ, and told him that if he wished to be a good Christian, he must burn all the idols of his country, and, instead of them, place a cross, and that everyone should worship it every day on their knees, and their hands joined to heaven; and he showed him how he ought every day to make the sign of the cross. To that the king and all his people answered that they would obey the commands of the captain and do all that he told them. The captain took the king by the hand and they walked about on the scaffolding, and when he was baptised he said that he would name him Don Carlos, as the emperor his sovereign was named; and he named the prince Don Fernand, after the brother of the emperor, and the king of Mazzava Jehan, and to the others each a name of his fancy. Thus, before mass, there were fifty men baptized."

"After dinner our chaplain and some of us went on shore to baptise the queen. She came with forty ladies, and we conducted them on to the scaffolding; then made her sit down on a cushion and her women around her, until the priest was ready. During that time they showed her an image of our Lady, of wood, holding her little child, which was very well made, and a cross. When she saw it she had a greater desire to be a Christian, and, asking for baptism, she was baptized and named Jehanne, like the mother of the emperor. The wife of the prince, daughter of this queen, had the name of Catherine, the Queen of Mazzava, Isabella, and the others each their name. That day we baptized eight hundred persons of men, women and children. The queen was young and handsome, covered with a black and white sheet; she had the mouth and nails very red, and wore on her head a large hat made of leaves of palm, with a crown over it made of the same leaves, like that of the Pope. After that she begged us to give her the little wooden boy to place in the place of the idols. This we did, and she went away."

"At last, in eight days, all the inhabitants of this island were baptized, and some belonging to the neighboring islands. * * * The captain-general went ashore every day to hear mass, to which

there came many of the new Christians, to whom he explained various points of our religion. One day the queen came with all her state. She was preceded by three damsels, who carried in their hands three of her hats; she was dressed in black and white, with a large silk veil with gold stripes, which covered her head and shoulders. Very many women followed her, with their heads covered with a small veil, and a hat above that; the rest of their bodies and feet were naked, except a small wrapper of palm cloth which covered their natural parts. Their hair fell flowing over their shoulders. The queen, after making a bow to the altar, sat upon a cushion of embroidered silk, and the captain sprinkled over her and over some of her ladies rose water and musk, a perfume which pleases the ladies of this country very much. The captain on that occasion approved of the gift which I had made to the queen of the image of the Infant Jesus, and recommended her to put it in the place of her idols, because it was a remembrance of the Son of God. She promised to do all this and to keep it with much care."*

Magellan, inspired by his success in Çebu, determined to follow it up by planting the cross in other islands. East of Çebu and separated from it by only a narrow strait, lies the little island of Mactan, the Matan of Pigafetta, which was ruled by two chiefs. One of these had expressed his willingness to accept Christianity, but had been restrained by the other. Magellan determined, against the advice of his friends, to punish the recalcitrant in person, and set out, on the night of April 26, with sixty Spaniards and a few native auxiliaries, in three boats. The king of Çebu and many of his chief men followed in their own boats, invited to see how Spaniards could fight. Magellan waited for daylight before landing. The water was shallow and the men were obliged to wade knee-deep a long distance, at least two bow-shots, says Pigafetta. Leaving eleven men to guard the boats, Magellan led the remainder to the shore, where he was met by a large body of natives, reckoned by Pigafetta at fifteen hundred, drawn up in three divisions, armed with bows and arrows, scimetars and bamboo lances with points hardened in the fire. The Spaniards who, protected by corselets and helmets, despised the native weapons, attacked this large force with ardor, but met with a stubborn resistance. Their ammunition was soon exhausted and Magellan, recognizing too late the danger of the situation, ordered a retreat. The islanders, elated at their

* This image, long worshiped as an idol, was recovered forty-four years later, when Miguel de Legaspé returned to Çebu with missionaries, and is said to be still preserved there in the Church of San Augustine, called also the Church of the Holy Infant of Çebu, together with the cross erected by Magellan.

advantage, pressed the Spaniards in front and on both flanks, and the retreat became a rout. Magellan, with a few of the bravest, attempted to stem the tide, but was cut of from the rest and surrounded, and after a gallant resistance, was killed with eight of his companions and four friendly natives. Pigafetta was wounded, but was among those who escaped and lived to narrate the mournful tale. He says:

"The captain had his right leg pierced by a poisoned arrow, on which account he gave orders to retreat by degrees; but almost all our men took to precipitate flight, so that there remained hardly six or eight of us with him. We were oppressed by the lances and stones which the enemy hurled at us, and we could make no more resistance. * * * As they knew the captain, they aimed especially at him, and twice they knocked the helmet off his head. He, with a few of us, like a good knight, remained at his post without choosing to retreat further. Thus we fought for more than an hour, until an Indian succeeded in thrusting a cane lance into the captain's face. He then, being irritated, pierced the Indian's breast with his lance, and left it in his body, and trying to draw his sword he was unable to draw it more than half way, on account of a javelin wound which he had received in the right arm. The enemies seeing this, all rushed against him, and one of them with a great sword, like a great scimetar, gave him a blow on the left leg, which brought the captain down on his face, then the Indians threw themselves upon him, and ran him through with lances and scimetars, and all the other arms which they had, so that they deprived of life our mirror, light, comfort, and true guide. Whilst the Indians were thus overpowering him, several times he turned round towards us to see if we were all in safety, as though his obstinate fight had no other object than to give an opportunity for the retreat of his men. We, who fought to extremity and were covered with wounds, seeing that he was dead, proceeded to the boats, which were on the point of going away."

Magellan's sad fate throws a considerable light on his character, and shows that though he possessed many of the qualities of a great captain, his bravery was marred by rashness and his judgment impaired by credulity. The sequel proves that he was no match in cunning for the king of Çebu. As soon as that breechless potentate, who had watched the fight from a safe distance in his boat, saw that the commander of the Spaniards had fallen before the weapons of the islanders, he forgot his Christian professions, and began to plot how he could rid himself of the remainder of his

unwelcome guests. A few days after the return to Çebu, he invited Barbosa and Juan de Serrano, who had succeeded to the command, and others, to a great feast and deliberately murdered twenty-six of his newly-made brethren. After this sad experience, the Spaniards, now greatly reduced in numbers, went to the island of Bohol, southeast of Mactan, where they transferred the equipment of the Concepcion to the other ships and burned her. Under the command of Juan Sebastian del Cano, they then set sail again for the Moluccas and, after a visit to Borneo, finally reached Tidore, one of the spice islands. There they loaded both vessels with cloves and, fearful of the Portuguese, who had already laid claim to the islands, they sailed, the Trinidad for Panama and the Vittoria for Spain. The former never reached her destination, but the latter, after a stormy voyage around the Cape of Good Hope and the loss of thirteen of her men, captured by the Portuguese at the Cape Verde Islands, arrived with only eighteen men on board at San Lucar, whence she had sailed just three years before. The Vittoria, whose representation on the seal of the Hakluyt Society is so familiar, was thus the first ship to sail around the earth. The Emperor, in commemoration of the event, gave to Sebastian del Cano, her commander, for his armorial bearings, a terrestrial globe, with the grand motto "Primus me circumdedisti." But as Magellan had previously sailed around the Cape of Good Hope to the Asiatic Archipelago, and had in his voyage westward reached nearly the same point, the world has universally given to him, the discoverer of the Philippines, the credit of being the first to circumnavigate the globe.

NOTES ON THE DESCRIPTION OF LAND FORMS.—V.

THE PLACE OF DEDUCTION IN THE DESCRIPTION OF LAND FORMS. It would appear from certain reviews in European geographical journals that there is an impression abroad to the effect that the use of deduction in geographical studies, particularly in relation to land forms, is an American innovation. If this were really the case, it would be highly complimentary to American and by no means flattering to European geographers; for inasmuch as the explanatory or evolutionary treatment of land forms is coming in these modern days to be more and more generally adopted as superior to any other means of treatment yet devised, and inasmuch as deduction is an essential process in determining the truth about the evolution of existing forms from earlier forms, it follows that the modern treatment of land forms cannot be successfully accomplished if deduction is ruled out. But it is by no means true that European geographers have neglected this important mental process. A good number of examples, some of which are briefly instanced below, might be cited to show a highly profitable use of deduction by well-known geographers of the Old World. Nevertheless, if international comparisons are to be indulged in, it may be admitted that deduction has been used less carefully and thoroughly, less consciously and intentionally, by many European geographers than by some American; and to just that extent is European treatment of land forms in danger of lagging behind American treatment.

But there is another aspect of this question which is often misapprehended by those European writers who do not consciously and habitually give deduction its merited place in their own studies. It seems sometimes, when along with other mental processes such as invention and comparison, deduction is given proper rank, that the European reviewer finds the importance thus assigned to deduction is much higher than that which it receives in his own studies, and he therefore names the whole method of investigation after this, to him, striking element. It would be more logical to name such a method of investigation the analytical method, since its essential quality is the close analysis of various possible solutions, and since in such analysis deduction is, as above noted, only one of the several mental processes that holds a necessary place. Again, it seems as if reviewers have sometimes assumed that the investigation of a geographical problem must have been largely deductive, because a deductive order of statement is employed in the presentation of the results; but this is by no means necessarily the case. The deductive method of presentation is so effective as a means of stating the results of an investigation to mature readers, that it may

be advantageously employed even if the results were reached largely by induction. It surely happens often enough that an observer, who has not had much occasion to employ deductive methods until after he has gained an abundant store of facts by outdoor observation, may nevertheless prefer to open the statement of his final results by announcing them as deductions from the general principles that he has established in good part by induction; and he may only on a later page substantiate his deductions by adducing appropriate examples of actual occurrence.

A sufficient reason for the choice of the deductive method of presentation for mature readers is that it is more concise and more easily understood than any other explanatory method. It is therefore desirable to distinguish between deduction employed as a method of exposition and deduction employed as a means of investigation; and furthermore to recognize that deduction, skilfully employed, aids in giving the valuable quality of clearness to exposition, just as deduction appropriately applied and guarded, aids in giving the invaluable quality of safety to an investigation. Whether deduction characterized the process of investigation as well as that of presentation in the following examples from German sources, cannot be immediately determined; but wherever it entered the treatment of the problems under discussion, it was evidently a helpful and powerful aid to the other mental faculties that were employed.

One of the most famous European examples of the use of deduction is that by v. Richthofen on the production of *Abrasionsflächen*,[8] first presented in connection with his observations in China in 1870; afterwards in his "Führer für Forschungsreisende" (Berlin, 1886, 353-364), in which this highly esteemed geographer independently reproduced the deductive discussion regarding plains of marine denudation which Ramsay had given about twenty years before (Denudation of South Wales. *Mem.* Geol. Surv. Gr. Britain, i, 1846). Both of these able and original thinkers surely had abundant facts, geological and geographical, in mind; yet both employed a largely deductive method in setting forth the consequences of the hypothesis of marine planation. Neither of them, however, considered the alternative hypothesis of normal subaerial planation; neither of them therefore could substantiate their conclusions by showing that the plains, which they regarded as of marine origin, had all the appropriate features which such plains ought to have, and none of the particular features which plains of normal planation ought to have. But in this respect Ramsay and v. Richthofen were like some of their successors who, in discussing the possibility or normal planation with respect to the general baselevel of the ocean, overlooked the possibility of arid plantation independent of the ocean as baselevel, until this important theoretical consideration was introduced by Passarge. Evidently then the danger involved in the explanatory description of land forms does not lie so much in the use of hypothesis and deduction as aids in reaching explanation, as it does in the failure to employ invention of

hypotheses and deduction of consequences actively and thoroughly enough to rule out the chance of error. If there is any one lesson regarding the use of deduction that is to be drawn from the work of pathfinders like Ramsay and v. Richthofen regarding the genetic treatment of land forms, it is that deduction ought to be employed even more thoroughly and freely than they employed it.

A careful and conscious use of deduction is seen in Philippson's "Beitrag zur Erosionstheorie" (*Pet. Mitt.*, xxxii, 1886, 67-79), in which a conscious effort is made to study out deductively the nature of the slope to which a river valley will be reduced by indefinitely long-continued, uninterrupted erosion, and from which concrete cases are intentionally excluded in order to give sufficient place for theoretical considerations. Philippson here wisely examines so artificial a case as that of a smoothly sloping land surface of uniform structure, that is supposed to have been suddenly laid bare from the sea (76), and proceeds to deduce the changes that it will suffer under the action of consequent streams (although he does not call them by this handy name); and he is fully justified in doing so, because this simplified ideal case serves him as an excellent beginning from which more complicated natural cases are afterwards approached. The importance of weathering, creeping, and washing of soil in the reduction of interstream areas to faint relief in the late stage of an uninterrupted normal cycle of erosion is, however, underrated, and the importance of the lateral swinging of rivers in the production of subaerial plains is somewhat exaggerated in other writings of this author; but on the other hand Philippson has elsewhere briefly presented an extremely valuable deductive view ("Zur Morphologie des Rheinischen Schiefergebirges," *Verhandl. XIV. deut. Geogr'ntages*, 1903, 193-205. V. p. 199-) as to the possible dissection of a normal peneplain without its being elevated from the position in which it was formed; for inasmuch as a peneplain a thousand miles or more inland from the ocean must stand at a significant altitude above sea level, its rivers will be revived and its surface will be sharply dissected by the revived rivers, if the region between the peneplain and the ocean is depressed, all the better if the intermediate region is submerged so as to bring the shore line against the fault scrap or monoclinal slope by which the undisturbed peneplain is then bordered. This important principle has not been sufficiently recognized by those American geographers who, following the brief hints of Marvine (U. S. Geol. and Geogr. Surv. Territories, *Ann. Rep.* for 1873, 1874, 144) and the fuller discussions by Powell ("Exploration of the Colorado River of the West," Washington, 1875, 212), have deductively developed the conditions under which peneplains should be formed, and who have universally regarded the dissection of a peneplain as proof of its elevation. An application of Philippson's principle may be found in articles by Cvijič on peneplains in the Carpathians ("Entwicklungsgeschichte des Eisernen Tors. *Pet. Mitt., Ergänz'hft.* 160, 1908; v, p. 52-; Also:—"Peneplains und epeirogenetische Bewegungen der Sudkarpathen. *Pet Mitt.*, liv, 1908, 114-116);

but neither Philippson nor Cvijič has deducted or otherwise indicated means of determining the share that the possible elevation of the peneplains themselves may have had, when conjoined with the depression of seaward lands, in causing dissection. Deduction of special consequences for each of these possibilities is therefore still to be desired.

No more striking example of the value of deductive treatment in a geographical problem can be found than that afforded by Passarge's brief discussion of *Rumpfflächen und Inselberge* (*Zeitschr. deut. geol. Gesellsch.* lvi, 1904, *Protokoll* 193-209. See also:—"Die Inselberglandschaften im tropischen Afrika." *Naturwiss. Wochenschr.*, iii, 1904, 657-665). Here for the first time is clearly set forth the remarkable possibility—strangely overlooked by previous students—that a desert region of interior drainage may be reduced to a plain, truncating all manner of structures indifferently, by the combined action of arid weathering, winds, and occasional rains; and that the plain will stand at no definite altitude in relation to sea level. True, the conditions demanded for the realization of extensive desert levelling are peculiar, and probably exceptional in the earth's history; for they include the persistence of an arid climate over a very large continental mass which must stand undisturbed for geological ages. Nevertheless, Passarge's deduction of his consequences from his premises seems to be correct, whether his actual examples in South Africa are correctly interpreted or not. His use of deduction is made manifest by such phrases as:—*"Nehmen wir also an,"* . . . *"Voraussetzung ist, dass"* . . . and *"Welches wären voraussichtlich die Folgen gewesen?"*, as well as by the repeated use of the auxiliary verb, *müssen,* which has no place in the record of observational studies. Of course, arid planation may also take place with respect to the normal baselevel of the ocean in desert regions which slope to the sea; but even if some or all of the arid plateaus of Africa should eventually prove to be of such lowly origin, afterwards uplifted, instead of having been produced as interior plains at their present altitude, as Passarge supposes, the value of his deductions regarding the general processes and results of arid planation must hold good. Indeed, in view of their great success and importance, one must wish that he, an experienced explorer of desert regions, had himself more fully deduced and explicitly stated the expectable earlier stages of the arid cycle in their orderly progress toward arid planation, and that he had not left to a geographer of less experience in the observational study of desert lands the deductive elaboration of the youthful stage of many independent basins of centripetal drainage and central aggradation; of the early mature stage of integrated drainage, in which the higher independent basins of youth come to be tributary to a main lower basin where heavy aggradation takes place; of the late mature stage in which exportation of dust by the winds degrades the main basin faster than it is aggraded by inwashed waste; and of the stage of old age, in which even the main basin of heaviest aggradation has been swept

clean, and a flat rock floor developed far and wide, here and there veneered with a thin wash of gravel and sand, or interrupted by surviving Inselberge.

MOUNTAIN PASSES. Studien über Gebirgspässe mit besonderer Berücksichtigung der Ostalpen. Versuch einer Klassification. Von Dr. Johann Sölch. (*Forsch. z. deut. Landes-und Volkskunde, Stuttgart,* xvii, 1905, 119-273). This comprehensive essay forms an excellent example of the intentional and careful use of the deductive method for the presentation of the results of a geographical investigation. There is internal evidence that the accumulation of observed facts and the formation of induced generalizations accompanied, if they did not precede, the deduction of a systematic sequence of ideal examples: but to repeat in a published essay the necessarily irregular progress of an investigation, with many alternations between induction and deduction, would be an extremely ineffective method of acquainting the reader with the results reached by the writer. A deductive order of statement was therefore advisedly chosen; but it is accompanied and followed by the citation of many facts of actual occurrence, by means of which the correctness of the deductions is fortified.

The essay opens with a well-considered chapter (127-135) on the concepts implied by the term, pass, which shows that it may be employed simply to denote an element of form, a mere notch in a mountain crest never traversed by human foot, as well as in the more special anthropogeographical sense of a depression in a mountain range through which a single path or road connects a number of roads that converge toward the mountain base from the lower lands on either side. The second chapter (136-145) gives an empirical statement of the morphology of mountain passes: in the opinion of the reviewer this might have been well replaced by an explanatory summary at the end of the essay. Then comes the main body of the work, a discussion of the origin and development of mountain passes, in which deduction occupies an advantageously prominent place. A special section is given to a consideration so abstract as "die konstruktiven Gebirgspässe" (146-152), in which the effects of deforming a smooth surface by folding and faulting are elaborately set forth. A definite preparation is thus made for two following sections on "die fluviatilen Destruktionspässe" (153-195) and "die glazialen Destruktionspässe" (194-263). In the first of these two sections special attention is given to the gradual modification of constructional or initial passes by the action of ordinary or normal destructive processes, including weathering and creep as well as stream erosion; farther on, the relation of passes to the erosion of unsymmetrical divides, and to various kinds of river captures, is elaborately deduced (162-), the progressive change of form with the advance in an imaginary cycle of erosion being systematically set forth. Under the second heading, the importance of glacial erosion in deepening pre-existing notches and in producing new ones is explained with much detail. Notches in the back wall of enlarged cirques (Karpässe, 195) belong here; as do also those broad, flat-floored trough passes ("glaziale

Transfluenzpässe," 206), produced by heavy glaciers that overflowed preglacial divides and wore them down to more open form. Preglacial notches that have been deepened by the overflow of glacial distributaries ("glaziale Diffluenzpässe," 243) are also shown to be of importance. Numerous examples are cited, chiefly from the Alps. Had Sölch's essay had better page headings and paragraph headings, its abundant material would have been more easily read; and had it been illustrated by simple diagrams of type forms, its value would have been greatly increased.

Terraces in south-central Italy. A. Galdieri. Le terrazze orografiche dell' alto Picentino a nord-est di Salerno. (Boll. Soc. Geogr. Ital., xxix, 1910, 37-116). The author of this welcome contribution to the geography of Italy is a member of the Geographical Institute of the University of Naples. He opens his essay by saying that, as here for the first time a group of river terraces in southern Italy is illustrated, it appears desirable to depart somewhat from the usual method of scientific presentation—[whatever that may be]—and to make his account as elementary as possible, avoiding overabundant technical terms of difficult meaning. He therefore devotes a few introductory lines to recalling the familiar principles regarding the tendency of water to wear down the lands, and adds a brief explanation of the origin of terraces by the lowering of a river level, whereby the remnants of its former valley floor remain as lateral benches, which as erosion progresses become more extensively eroded and less easily recognizable. He then devotes 15 pages to the narrative and inductive description, with half-tone illustrations, of a series of rock benches, overlaid by heavy gravel beds, 50-75 m. in thickness, which now stand above the valley bottom of the upper Picentino, rising up stream from 220 to 250 m., and with much patience demonstrates that they are indeed terraces of the kind indicated at the opening of his essay. Six more pages are next given to the inductive demonstration of the existence of a still higher and more dissected group of gravel-covered terraces; and after this, "without further delay in other minute observations and superfluous demonstrations," brief mention is made of a narrow and discontinuous terrace at a much lower level than the first one mentioned. Not until the 23d page of the essay does the reader find a simple cross-section, on which the relative position of the three groups of terraces is concisely figured. Had this simple diagram been placed at the beginning, and had the items of fact been presented as related to the middle, the uppermost, and the lowest terrace, the reader would have been greatly aided in acquiring the writer's meaning. Still further aid would have been given if, following the introductory use of the diagram—and following also, if desired, an explanatory exposition of a simple deductive scheme, whereby terraces at successively lower levels and of less breadth may be produced—explicit statement had been made that the uppermost terrace consists only of much dissected lateral remnants of a wide-floored, late mature valley, above which the un-

terraced mountains rise in subdued forms; that the middle terrace represents a deeper valley which was somewhat less maturely widened; while the narrow strips of the lowest terrace indicate a still deeper valley which was only submaturely opened; and the present valley, incised beneath the lowest terrace, is comparatively young. Unfortunately this simple generalization is not explicitly announced, although it is graphically shown in the helpful but belated cross-section.

The omission of so illuminating a generalization can hardly be because its terminology is too difficult for the readers to whom the essay is addressed, but rather because of the habitual diffidence of European writers regarding the use of generalized or deductive phrases for the prompt presentation of their results at the beginning of their essays. Deduction is, however, abundantly used in the later pages of the essay, when, after showing that terraces similar to those of the upper Picentino occur in neighboring valleys, the origin of the terraces is discussed in some detail. The effects of land movements, of depression of sea level, and of change of climate are considered; the consequences of each possibility are determined deductively, and the success of each supposition is measured by the degree of accordance shown when its consequences are confronted with the appropriate facts. Evidently, then, as far as this essay represents an approved European method of presentation, deduction is an essential element in it, but this indispensable mental process is used chiefly in discussion after exposition h s been completed, rather than as an aid in exposition itself.

As to the results gained by Galdieri from the deductive examination of the several hypotheses of terrace formation:—It is concluded that the climatic changes associated with the successive epochs of the glacial period were primarily responsible for the alterations between erosion of the valley floors and deposition of the heavy gravels upon them. Land movements are regarded as of subordinate importance. A distant reviewer, not acquainted with the ground, must not venture to criticize the application of this conclusion to the special case of the Picentino; but he may point out that, in so far as the deductive discussion of the problem is concerned, it would demand a very strong climatic change to cause, in a river of moderate length, the deep erosion of new valleys beneath the broadly opened rock-floor of a first formed, *late mature* valley, unless land movement acted as an important contributory cause. It would seem, indeed, as if the stage of valley development, as represented by width rather than by depth of valley floor, had received insufficient consideration in the deductive discussion as well as in the introductory exposition of the Picentino problem.

W. M. Davis.

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1909 Hanna, Charles A.
1904 Hansmann, Carl A.
1888 Harbeck, Charles T.
1888 Hard, Anson W.
1905 Hardenbergh, William P.
1901 Hardie, Wainwright.
1900 Harding, Edward.
1900 Hardley, J. Wheeler.
1909 *Harkness, Charles W.*
1911 Harris, W. R.
1906 Hart, Richard P.
1897 Hart, Walter T.
1905 Hartzell, J. Culver.
1904 *Haupt, Louis, M.D.*
1905 Havemeyer, H. O.
1859 *Havemeyer, John C.*
1902 *Havemeyer, William F.*
1894 Haven, J. Woodward.
1909 Hawxhurst, Robert, Jr.
1909 Hayes, S. W.
1889 Haynes, Henry W.
1891 Hazard, Frederick R.
1897 *Hearn, George A.*
1883 *Hebert, Henry B.*
1902 Hedge, Frederic H.
1903 Heimann, Julius.
1901 Hentz, Henry.
1899 *Herbert, John W.*
1909 Herbert, William.
1903 Herrmann, Nathan.
1900 Herzog, F. Benedict, Ph.D.
1904 *Hess, Selmar.*
1904 *Heurich, C.*
1903 *Hewitt, Peter Cooper.*
1900 Hewlett, Walter Jones.
1901 Heydt, Herman A.

Date of Election.

1906 Hickey, Jas. H.
1906 Higginson, Adm. Francis J., U.S.N., Retired.
1909 Higginson, James J., Jr.
1894 Hildreth, J. Homer.
1903 Hill, Charles B.
1890 Hill, James J.
1908 Hill, Samuel.
1909 Hillhouse, J. Ten Broeck.
1904 *Himmelwright, A. L. A.*
1887 Hinchman, Walter.
1881 Hinman, Russell.
1903 *Hirsch, Robert B.*
1904 Hitchcock, Mrs. Roswell D.
1905 Hobby, C. M., M.D.
1904 Hoe, Alfred G.
1897 Hoe, William A.
1876 Hoes, William M.
1897 Hoey, Rev. Joseph L.
1901 Hoffman, Charles F., Jr.
1910 *Hoffman, Samuel V.*
1872 *Holbrook, Levi.*
1909 Holland, Arthur L., M.D.
1876 Holt, Henry.
1902 Holton, Henry D., M.D.
1901 *Hopkins, George B.*
1896 *Hotchkiss, Miss C. W.*
1898 Howell, Maxwell D.
1909 Howell, Wilson S.
1905 Hoxie, William D.
1909 *Hoyt, Alfred W.*
1888 *Hoyt, Henry R.*
1906 Hubbard, Geo .D.
1906 *Hubbard, John.*
1898 *Hubbard, Robert J.*
1901 *Hubbard, Thomas H.*
1885 Hubbard, Walter.
1900 Hudnut, Richard A.
1897 Humphreys, Alexander C., M.E.
1911 Huntington, Mrs. Arabella D.
1893 *Huntington, Archer M.*
1909 Huntington, Charles P.
1909 *Huntington, Henry E.*
1910 Hutting, Miss Ella.
1883 *Hurry, Edmund Abdy.*
1909 Hurst, George D.
1889 *Hurtt, Frank D.*
1890 Husted, Seymour L., Jr.
1883 Hyde, E. Francis.

Date of Election.

1910 *Hyde, Henry St. John.*
1901 *Hyde, James H.*
1905 Iddings, Andrew S.
1905 Iddings, Daniel W.
1899 Insull, Samuel.
1909 Irving, Cortlandt.
1890 Irving, Walter.
1874 Iselin, Adrian, Jr.
1887 *Isham, Charles.*
1881 *Ives, Brayton.*
1903 Jackson, A. Wendell.
1886 *Jackson, Rev. Samuel M.*
1897 Jackson, Theodore F.
1886 Jacobi, Abraham, M.D.
1891 Jaffray, Robert.
1894 James, Arthur Curtiss.
1911 James, Norman.
1890 James, Walter B., M.D.
1891 Jaques, W. H.
1906 Jarves, Deming.
1903 Jarvie, James N.
1879 Jay, William.
1893 Jenkins, Michael.
1895 Jennings, Oliver G.
1911 *Jennings, Walter.*
1902 Jessup, Henry W.
1880 *Jewett, George L.*
1906 *Jewett, W. K.*
1881 Johnson, Bradish.
1901 Johnson, Edward C.
1906 *Jones, Charles Landon.*
1906 Jones, Dwight A.
1888 *Jones, Oliver L.*
1909 Judson, Henry I.
1885 Juilliard, A. D.
1901 Julian-James, Mrs. Cassie.
1904 Jungmann, J., M.D.
1906 Junkin, J. de F., Jr.
1898 Kahn, O. H.
1909 Kammerer, Robert C.
1881 *Kane, Grenville.*
1893 *Kane, Henry Brevoort.*
1895 *Kean, Hamilton Fish.*
1908 Keck, Thomas A.
1880 *Keene, James R.*
1888 Kellogg, Charles.
1897 Kemmerer, M. S.
1903 Kemp, James Furman.
1873 *Kennan, George.*

Date of Election.

1901 Kennedy, E. G.
1901 *Kennedy, George G., M.D.*
1888 Kennedy, H. Van Rensselaer.
1904 Kenyon, Robert N.
1906 Kenyon, Wm. Houston.
1885 *Keppler, Rudolph.*
1903 Kerr, John B.
1883 Kerr, Walter.
1909 Keyes, William F.
1886 *Kidder, Camillus G.*
1904 Kidder, Edward H.
1897 Kimball, Alfred R.
1883 King, D. H., Jr.
1882 *King, George Gordon.*
1892 King, John Hurtin.
1904 King, W. Nephew.
1901 Kirby, Thomas E.
1881 Kirsch, Louis.
1906 Kittredge, Geo. L.
1911 Klein, S. R., M.D.
1887 *Knight, George T.*
1901 Kohlman, Charles.
1897 Kohn, S. H.
1901 Kohnstamm, Emil V.
1906 *Kuhn, August.*
1909 *Kunhardt, Henry Rudolph 3d.*
1905 La Fétra, Linnæus Edford, M.D.
1910 Lampland, Carl Otto.
1909 Landers, George M.
1895 Landon, Francis G.
1898 Lane, Wolcott G.
1882 Langdon, Woodbury.
1881 *Langdon, Woodbury G.*
1882 Lapham, Lewis H.
1904 *Laughlin, George M.*
1909 Lawrence, Emlen N.
1910 Lawrence, Enoch P., M.D.
1902 Lawrence, John Burling.
1904 Lawrence, W. B.
1909 Lawrence, William W.
1903 Lawson Victor F.
1906 Lawton, James M.
1909 Leask, George.
1886 *Leete, Charles H.*
1906 *Leffingwell, Rev. C. W., D.D.*
1903 Lehmaier, James M.
1909 Leland, Charles H.
1905 Lemon, Dr. J. S.
1909 Le Roy, Edward A., Jr.

Date of Election.

1903 Lesher, Arthur L.
1901 *Leupp, William H.*
1902 Leverich, S. Duncan.
1904 Levi, Emil S.
1896 *Lewis, Clarence McK.*
1881 *Libbey, William.*
1903 Lincoln, Lowell.
1902 Linderman, Garrett B.
1905 Lindsey, Edward.
1899 *Lippincott, Henry H.*
1903 Lisman, Frederick J.
1910 Littell, John MacGregor.
1881 *Little, Joseph J.*
1897 *Livingston, Goodhue.*
1897 Lobenstine, William C.
1909 Locatelli, E. H.
1909 Locke, Jesse Albert.
1904 Lodge, Henry Cabot.
1900 *Loeb, Morris.*
1891 Loewy, Benno.
1906 Loines, Stephen.
1903 *Lorillard, Pierre.*
1878 *Loubat, J. F., LL.D.*
1908 Loughran, Dr. Robert L.
1883 Lounsbery, R. P.
1876 *Low, A. Augustus.*
1875 *Low, Seth, LL.D.*
1903 *Low, Willam G.*
1905 *Lowell, Percival.*
1909 Lybrand, William M.
1889 Lydig, David.
1900 Lyman, Frank.
1888 *Lynch, James D.*
1906 Lyon, David H.
1895 *McCord, William H.*
1887 McCready, N. L.
1909 McCurdy, Robert H.
1906 McDonald, William.
1903 McDougall, Walter.
1907 McDowall, Walter R.
1901 *McFarlane, C. T.*
1888 McKeever, J. Lawrence.
1898 McLean, Donald.
1904 *McMillan, William Northrup.*
1895 McMillin, Emerson.
1903 McWilliams, Daniel W.
1903 Maas, Gustavus.
1905 Macdonald, Benjamin J.
1909 MacDougal, D. T.

Date of Election.

1905 MacDougall, George R.
1903 *Mackay, Clarence H.*
1883 *Mackay, Donald.*
1884 *MacKellar, William.*
1890 Mackey, Charles W.
1898 MacKie, Charles Paul.
1901 Macy, George H.
1901 *Macy, V. Everit.*
1904 Mager, F. Robert.
1899 Mahl, William.
1903 Mann, William D'Alton.
1905 Manning, Charles H., U.S.N.
1874 Marble, Manton.
1904 Marcou, John B.
1895 Marcus, George E.
1909 *Markle, George B.*
1909 *Marling, Alfred E.*
1888 *Marquand, Henry.*
1898 Marsh, Joseph A.
1901 Marshall, Charles H.
1897 *Marshall, Louis.*
1898 Marston, Edwin S.
1875 *Martin, Bradley.*
1910 Martin, Bradley, Jr.
1911 Martin, Fred. Townsend.
1911 Martin, Howard Townsend.
1888 *Martin, Oswald J.*
1910 *Martin, Newell.*
1910 Martin, Dr. Winfred R.
1909 Marwick, James.
1888 *Mason, Alexander T.*
1901 Mather, Samuel.
1901 Matthews, Albert.
1903 Maxwell, Francis Taylor.
1901 Maxwell, Robert.
1906 Maxwell, Wm.
1905 Meeker, Stephen J.
1891 Meeks, Edwin B.
1909 Melcher, John S.
1902 *Mellen, Charles S.*
1911 Meredith, Rev. Fred. Charles.
1904 Meredith, William T.
1909 Meyer, Eugene, Jr.
1901 Meyer, Harry H.
1910 Middlebrook, George H.
1897 Millar, George W.
1909 Miller, Francis Trevelyan.
1901 *Miller, Dr. George N.*
1892 *Mills, A. G.*

Date of Election.

1911 *Mitchell, Albert M. Post.*
1909 Mitchell, Edward P.
1905 Mixer, Frederick K.
1909 Moffat, R. Burnham.
1905 *Mohr, Louis.*
1902 *Monks, John, Jr.*
1909 Monsen, Frederick I.
1890 Montant, Alphonse.
1909 Montgomery, William S.
1906 Moore, C. Arthur, Jr.
1906 Moore, Henry Du Bois Bailey.
1904 *Moore, John Bassett.*
1884 *Moore, Joseph, Jr.*
1910 More, Taylor.
1883 Morgan, E. D.
1906 *Morgan, Frederick G.*
1874 *Morgan, J. Pierpont.*
1901 *Morgan, J. P., Jr.*
1887 *Morgan, William Fellows.*
1889 Morgan, William H.
1906 Morrell, Joseph B.
1910 Morris, Dave H.
1874 *Morris, Henry Lewis.*
1897 *Morris, Mrs. Lewis G.*
1906 Morris, Lewis R., M.D.
1898 *Morris, Newbold.*
1902 *Mortimer, Rev. Dr. Alfred G.*
1908 Mortimer, Edmund.
1907 *Mortimer, Richard.*
1864 *Morton, Levi P.*
1909 Morton, Quincy L.
1910 Mosonyi, Emil.
1906 Mullins, Edwin Stanton.
1909 Munsey, Frank A.
1909 Murphy, Franklin, Jr.
1904 Myers, Joseph G.
1888 Myers, Theodore W.
1901 Neeser, John G.
1909 Neill, Robert L.
1909 Neilson, Henry A.
1910 Neilson, John.
1905 Nelsen, Dr. Wolfred.
1910 *Nesbitt, Abram G.*
1891 Neukirch, Chas.
1910 Nevin, Miss Blanche.
1899 Newbold, Clement Buckley.
1897 *Newell, Frederick Haynes.*
1899 Newton, James S.
1897 Nixon, Lewis.

Date of Election.

1908 North, Arthur Walbridge.
1897 Notman, George.
1906 Oakes, Charles.
1888 *Oakes, T. F.*
1898 Obermeyer, Joseph.
1879 *O'Brien, Thomas S.*
1910 Ochs, Adolph S.
1875 *O'Connor, Thomas H.*
1879 O'Gorman, Richard.
1909 Olcott, Dudley.
1901 O'Leary, H. A.
1909 Oliver, French E. D.D.
1910 Olsson-Seffer, Pehr., Ph.D.
1905 *Olyphant, Robert.*
1874 Olyphant, Robert M.
1875 *Opdyke, William S.*
1893 Operti, Albert.
1882 Oppenheim, Edward L.
1889 Orr, Alexander E.
1901 *Orvis, Charles E.*
1909 *Osborn, Henry Fairfield.*
1905 *Osborn, William Church.*
1910 Osborne, Thomas M.
1901 Outerbridge, Dr. Paul.
1896 Owen, James, C.E.
1895 *Owen, Miss Luella A.*
1905 *Packard, Ralph G., Jr.*
1898 *Paget, Almeric H.*
1909 Palmer, Frederick.
1889 Palmer, Stephen S.
1911 Pam, Max.
1899 *Parish, Edward C.*
1872 *Parish, Henry.*
1905 Parish, Henry, Jr.
1905 *Parker, Herschel C.*
1902 *Parker, James H.*
1905 Parks, C. W., C.E., U.S.N.
1886 Parris, Edward L.
1882 *Parrish, James C.*
1909 Parsons, Charles W.
1882 *Parsons, Mrs. Edwin.*
1905 Parsons, Herbert.
1882 Parsons, John E.
1910 Partridge, George H.
1902 Paton, David.
1897 *Paton, William Agnew.*
1909 Patten, William.
1907 Peabody, Charles A.
1909 Peabody, George Foster.

Date of Election.

1889 Peck, Charles E.
1898 *Pell, Frederick A.*
1906 *Pell, Howland Haggerty.*
1901 Pell, Stephen H. P.
1910 Penfield, Frederic Courtland.
1874 Penfold, William Hall.
1906 *Penniman, James H.*
1898 Pennington, William.
1890 *Perkins, William H.*
1908 Perry, Rufus Lewis.
1888 Perry, William A.
1891 Peters, Edward McClure.
1887 Peters, Samuel T.
1903 *Peters, William Richmond.*
1909 Pfeiffer, Curt G.
1906 Phelps, Dr. Gouverneur Morris.
1901 *Phelps, John J.*
1902 *Phipps, Lawrence C.*
1887 *Phoenix, Lloyd.*
1886 *Phoenix, Phillips.*
1889 *Pickering, Edward C.*
1905 Pickett, William Douglas.
1895 Pickhardt, Carl.
1902 Pierce, Henry Clay.
1906 *Pierrepont, R. Stuyvesant.*
1898 Piorkowski, Major A. E.
1885 *Planten, John R.*
1893 *Platt, J. D.*
1906 Platt, Lewis A.
1905 Plimpton, Dr. Warren O.
1890 *Plumb, Edward L.*
1884 *Plush, Dr. Samuel M.*
1906 Poe, I. N.
1906 Poor, Henry V.
1911 Poor, Ruel W.
1891 *Porter, Henry Kirke.*
1897 Porter, William H.
1909 *Porter, William L.*
1905 *Post, Abram S.*
1884 Post, George B.
1885 *Post, William Henry.*
1890 Potter, Edward Clarkson.
1898 Potter, Frederick.
1901 *Potts, Jesse W.*
1903 *Potts, Thomas.*
1880 Powell, Wilson M.
1910 Power, John A.
1897 Prentiss, George Lewis.
1909 Pruyn, Frederic.

Date of Election.

1886 Preyer, Charles.
1901 Purdy, J. Harsen.
1905 Putnam, Henry St. Clair.
1903 *Pyle, James Tolman.*
1894 *Pyne, M. Taylor.*
1898 *Pyne, Percy R.*
1906 *Queen, Emmet.*
1908 *Radford, Harry, V. M. Sc., C.E.*
1911 *Rainey, Paul J.*
1903 *Randolph, Evan.*
1906 Randolph, Stewart F.
1868 *Raven, Anton A.*
1905 *Raven, John Howard, D.D.*
1898 *Rawson, Edward Stephen.*
1890 Raymond, Charles H.
1886 *Raymond, R. W.*
1902 Rea, Samuel.
1901 *Rea, Thomas B.*
1902 *Ream, Norman B.*
1905 Reckefus, Charles V., Jr., M.D.
1898 Redding, Joseph D.
1903 Reed, Charles.
1911 Reid, Wallace.
1874 Reid, Whitelaw.
1911 Remsen, Charles.
1888 Renwick, Edward S.
1874 *Reynes, Jaime.*
1903 *Reynolds, James B.*
1882 Rhinelander, Charles E.
1909 Rhinelander, Rev. Philip M.
1898 *Rhinelander, Miss Serena.*
1886 *Rice, Isaac L.*
1903 Richard, Edward A.
1901 Riker, Samuel.
1874 Riker, William J.
1901 Rives, George Barclay.
1872 *Robbins, Chandler.*
1891 Robbins, Miss Harriet L.
1901 *Robertson, Julius.*
1907 Robinson, Dr. E. S.
1901 *Robinson, Nelson.*
1888 Robinson, William Moore.
1908 Rockwood, Charles G. Jr., Ph.D.
1903 Roe, Albert S.
1890 Roe, Major-Gen. Charles F.
1889 *Roelker, Alfred.*
1906 Rogers, Abbott S.
1887 *Rogers, Archibald.*
1905 Rogers, Edward L.

Date of Election.

1903 *Rogers, Robert.*
1896 Roncière, St. Croix de la.
1905 *Roosevelt, Franklin Delano.*
1868 Rose, Cornelius.
1903 Ross, Morgan R.
1911 Runyon, Walter Clark.
1905 Ruprecht, Philip.
1910 Rusch, Adolph, Jr.
1897 Rusch, Henry A.
1899 Russak, Frank.
1874 *Russell, Archibald D.*
1889 Ryan, Thos. F.
1906 Sachs, Arthur.
1906 Sachs, Paul J.
1905 Sachs, Samuel.
1909 Safe, Thomas Shaw.
1898 Salomon, William.
1911 *Saltus, J. Sanford.*
1901 *Sampson, Alden.*
1904 Sampson, Charles E.
1910 Sanderson, Edwin N.
1875 *Sandford, Elliott.*
1895 Sands, Robert C.
1908 San Marzano, Robert Asinari de.
1886 Satterlee, F. LeRoy, M.D.
1903 *Satterlee, Herbert L.*
1904 Saul, Charles R.
1870 *Schafer, Samuel M.*
1911 Scheftel, Edwin K.
1874 *Schermerhorn F. Augustus.*
1890 Schernikow, Ernest.
1911 Scheffelin, Schuyler.
1875 *Shiff, Jacob H.*
1902 *Shiff, Mortimer L.*
1903 Schirmer, Rudolph E.
1885 Schmelzel, William R.
1901 Schmid, Dr. H. Ernest.
1905 *Schott, Charles M., Jr.*
1888 *Schultze, John S.*
1882 *Schuyler, Spencer D.*
1902 *Schwab, Charles M.*
1883 Scott, Rufus L.
1911 *Scoville, Robert.*
1906 Scribner, Charles.
1895 Scudder, Moses L.
1905 Scull, Harry.
1909 Seabury, Charles B.
1909 Seaman, Louis Livingston, M.D.
1901 Seligman, Isaac N.

Date of Election.

1909 *Seligman, Jefferson.*
1887 Sellew, T. G.
1903 *Sells, Elijah W.*
1902 Seward, Frederick W.
1898 Seward, Gen. William H.
1893 *Sexton, Edward Bailey.*
1909 Seymour, Morris W.
1905 Shailer, William Griggs.
1871 Shaler, Major-Gen. Alexander.
1897 *Shardlow, Joseph.*
1903 Shaughnessy, Sir Thomas G.
1893 Shaw, Charles A.
1910 Shaw, Louis Agassiz.
1906 *Shaw, Walter W.*
1897 Sheehy, W. H.
1905 Sheffield, George St. John.
1888 Sheldon, Edwin B.
1888 *Sherman, Charles A.*
1886 *Sherman, George.*
1865 *Sherman, W. Watts.*
1898 Shillaber, William, Jr.
1876 *Sibley, Hiram W.*
1903 *Siegel, Henry.*
1903 Siegel, Jacob.
1903 Simpson, Ernest L.
1911 Simpson, John Boulton.
1910 Sinclair, Henry A.
1906 Slater, James.
1910 Sloan, Benson B.
1910 Sloan, Samuel.
1910 Sloan, William S.
1899 Smiley, Albert K.
1901 Smilie, Charles F.
1893 Smith, Benjamin E.
1890 *Smith, Sir Donald A.*
1902 Smith, Dr. E. Fayette.
1879 *Smith, E. Reuel.*
1906 Smith, George H.
1887 Smith, Nathaniel S.
1901 Smith, Ormond G.
1889 Smith, Philip Sherwood.
1910 Smith, Pierre J.
1890 Snow, Elbridge G.
1903 Snow, Fred W.
1909 Solari, Luigi.
1911 Souther, Charles Edward.
1880 *Southwick, Henry K.*
1906 Spangler, Harry A., M.D.
1883 Spence, Lewis H.

Date of Election.

1905 Spencer, Edwards.
1905 Spencer, Henry B.
1911 *Spencer, Lorillard.*
1906 Speranza, Gino C.
1905 *Speyer, James.*
1911 *Spingarn, Joel E.*
1856 Spofford, Paul N.
1910 Spottiswood-Mackin, Countess.
1909 Spring, Miss Anna Riker.
1904 Squires, Grant.
1897 Standish, Miles.
1905 Stanton, Robert Brewster.
1910 Staples, C. Bayard.
1909 Steese, James Gordon.
1907 Stefánsson, V.
1911 Stein, Enrico N.
1903 Steinway, Frederick T.
1904 *Sterry, John DeWitt.*
1879 Stetson, Francis Lynde.
1887 *Stetson, George W.*
1910 Stetson, John B., Jr.
1911 Stevens, Alexander H.
1906 Stevens, Arthur W.
1879 *Stevens, Frederic W.*
1901 Stevenson, Edward Luther, Ph.D.
1905 Stewart, John H. J.
1887 Stewart, Lispenard.
1878 Stewart, William Rhinelander.
1901 *Stickney, Charles D.*
1905 Stillwell, Arthur E.
1905 *Stillwell, Louis Buckley.*
1897 Stine, Marcus.
1904 Stokes, Anson Phelps.
1892 *Stokes, I. N. Phelps.*
1911 Stokes, J. G. Phelps.
1884 Stokes, James.
1889 Straus, Isidor.
1903 Strauss, Frederick.
1906 *Strong, Charles Hamot.*
1904 Strong, George A.
1904 Stuck, Rev. Hudson.
1873 Sturges, Frederick.
1875 Sturges, Henry C.
1906 Sturges, Rush.
1873 *Sturgis, Frank K.*
1901 Sturgis, Thomas.
1891 *Suckley, Robert B.*
1887 Sutton, J. Ford, D.D.
1903 Sutton, James F.

Date of Election.

1893 Swayne, Francis B.
1906 Sweet, Henry N.
1905 Swords, Henry C.
1882 *Tailer, Edward N.*
1906 *Talbot, Fritz B., M.D.*
1877 *Talcott, James.*
1889 Tatham, Charles.
1902 Taylor, Charles H., Jr.
1868 Taylor, Douglas.
1906 Taylor, Ellsworth M.
1906 Taylor, Frank B.
1895 Taylor, George.
1903 Taylor, Henry R.
1901 Taylor, Walter C.
1882 *Terry, John T.*
1876 *Terry, Rev. Roderick.*
1911 Thain, Charles C.
1883 Thalmann, Ernest.
1891 Thaw, Benjamin
1905 *Thebaud, Paul G.*
1905 *Thomas, William S., M.D.*
1898 Thompson, D. W.
1904 *Thompson, Mrs. Frederick F.*
1901 *Thompson, Lewis S.*
1911 *Thompson, Robert M.*
1898 Thompson, Walter.
1902 *Thomson, Elihu.*
1886 Thorne, Jonathan.
1890 Thorne, Samuel.
1911 Thorne, Samuel, Jr.
1891 *Tobey, Gerard C.*
1911 Tobey, Orville H.
1906 Townsend, Edwin S.
1900 Tracy, J. Evarts.
1911 *Tuck, Edward.*
1899 *Tucker, George F.*
1901 *Tuckerman, Alfred.*
1908 Tuckerman, Bayard.
1901 Tuckerman, Paul.
1900 Turnure, George E.
1909 Tweed, Charles H.
1911 *Udall, John Clark.*
1905 Uhle, John B.
1905 Ulich, H. P.
1891 Ullmann, Emanuel S.
1891 Ulmann, Ludwig.
1897 *Underhill, Eugene.*
1910 Vail, Theodore N.
1906 *Vaile, Joel F.*

Date of Election.

1887 *Van Alen, J. J.*
1897 Van Antwerp, William C.
1908 Van Boskerick, Miss Lizzie.
1907 Van Cortlandt, Robert B.
1889 *Vanderbilt, George W.*
1878 *Vanderbilt, William K.*
1906 Van Dusen, Dr. James Wallace.
1910 Van Gerbig, Barend.
1902 *Van Rensselaer, A.*
1905 Van Sinderen, Howard.
1887 *Van Slyck, George W.*
1891 *Van Winkle, Edgar B.*
1906 Veeder, Curtis H.
1903 Veit, Richard C.
1900 *Vetter, Dr. Charles.*
1909 Viquez, Cleto Gonzalez.
1901 von Briesen, Arthur.
1875 *von Post, Herman C.*
1903 von Schmid, J. O.
1907 Wack, Henry Wellington.
1890 *Wadsworth, Herbert.*
1898 *Wadsworth, Wm. Austin.*
1898 Wait, William B.
1908 Walker, Amasa.
1900 Walker, Henry Freeman, M.D.
1905 Wallace, Dillon.
1898 Warburg, Felix M.
1911 *Warburg, Paul M.*
1905 Ward, John Gilbert.
1911 Warner, George H.
1895 Warren, William R.
1909 Wasson, Rev. Dr. James B.
1889 Waterbury, John I.
1911 *Waterman, Frank D.*
1898 *Watkinson, George.*
1884 *Watson, George H.*
1876 Wedemeyer, A. J. D.
1911 *Weekes, F. Delano.*
1900 *Wehrhane, Charles.*
1903 *Weir, Col. John.*
1895 Wells, Charles W.
1905 *Wells, Mrs. John.*
1905 Wells, T. Tileston.
1907 Wentz, Theodore.
1910 Wemyss, Miss Henrietta C.
1898 Weston, Edward, Sc.D., LL.D.
1906 Weston, Frederick W.
1888 Wetmore, Edmund.
1874 *Wetmore, George P.*

Date of Election.

1901 *Wetmore, W. S. K.*
1872 *Wetmore, William Boerum.*
1905 Wheeler, John Davenport.
1906 Wheeler, Samuel H.
1907 Whinery, Charles C.
1905 Whitaker, John E.
1887 White, Alfred T.
1887 *White, Henry.*
1887 *White, J. LeRoy.*
1886 *White, S. V.*
1887 White, William Augustus.
1905 White, William H.
1901 Whitehouse, William FitzHugh.
1891 Whitney, Milton B.
1902 *Whitney, W. Beaumont.*
1908 Wickersham, George W.
1901 *Willets, Howard.*
1900 Willets, John T.
1882 *Williams, David.*
1902 *Williams, John Skelton.*
1911 Williams, Dr. M. B.
1906 *Williams, Richard H.*
1901 *Williams, Timothy S.*
1893 Wills, Charles T.
1903 Wilson, Henry R.

Date of Election.

1870 *Wilson, Gen. James Grant.*
1909 Wilson, M. Orme.
1875 Winslow, Gen. Edward F.
1901 Winslow, John Flack.
1902 Winter, Emil.
1900 *Winthrop, Grenville L.*
1888 Witherbee, Frank S.
1891 Wolcott, Henry Roger.
1897 Wolff, Emil.
1909 Wolff, M. A.
1905 Wood, Henry A. Wise.
1903 Wood, Henry R.
1911 Wood, William C.
1898 Woods, Edward A.
1906 Worrall, Charles Addams.
1904 Wright, J. Dunbar.
1886 Wright, William Phillips.
1907 Wunderlich, Frederick W., M.D.
1902 *Wyckoff, Clarence F.*
1902 *Wyckoff, Edward G.*
1901 Wyckoff, William F.
1905 Yeisley, George C., D.D.
1884 *Zabriskie, Andrew C.*
1898 Zaring, Charles W.
1905 Zickel, S.

GEOGRAPHICAL RECORD

AMERICA

NEW MONTHLY CLOUDINESS CHARTS FOR THE UNITED STATES. In 1891 Gen. A. W. Greely, Chief Signal Officer of the Army, published the first set of monthly cloudiness charts for the United States (Washington, D. C., *fol.* 1891). The longest period for which data were then available was 18 years (1871-1888), and many stations had records for shorter periods, some for less than 5 years. In the "Report of the Chief of the Weather Bureau for 1896-97" there was later published a mean annual cloudiness chart on the basis of more data and of longer records. Mr. Kenneth McR. Clark, a student of Harvard University, has now constructed a new set of cloudiness charts (monthly and annual), which are reproduced, with a brief discussion, in the *Quarterly Journal* of the Royal Meteorological Society for April, 1911. Data for 77 stations have been used, at which averages are based on periods of 30 years or more. There were also 31 stations with periods of less than 10 years, and 15 with 5 years or less. The short-period stations were given less weight than the longer-period stations; some stations were omitted because of local topographical influences upon their cloudiness, and some long-period stations were given less weight when their data differed considerably from those of surrounding stations.

The most marked features appear over the Pacific Coast and the Great Lakes.

On the North Pacific Coast the combined effect of the Coast Ranges and the on-shore westerly winds causes a high percentage of cloudiness, especially in winter, when the northern storm track swings down over this region. The Great Lakes region shows a similar large amount of cloudiness, especially in the winter, because of its location on or near the northern cyclonic tracks and because of the presence of the water surface. The California Valley, protected from moisture-bearing winds by the Coast Range, shows the minimum cloudiness for the country. R. DEC. WARD.

CLIMATE OF PUGET SOUND BASIN. Buried away in a "Reconnoissance Soil Survey of the Eastern Part of the Puget Sound Basin, Washington (U. S. Dept. of Agric. Bur. of Soils; Field Operations, 1909. Washington, D. C., 1911) there is a short account of the climate of the region, prepared by Professor E. J. Saunders, of the University of Washington. The discussion consists of twelve pages of text, together with sketch maps showing annual precipitation, average monthly precipitation, number of clear days and number of days with rain, average lowest and highest temperatures, and average dates of first and last frost. It is a satisfaction to note (p. 26) the following statement: "Many have ascribed this equable climate to the Japan Current, but—the prevailing westerly winds, the cyclonic storms, and the condensation of moisture are the chief factors in causing these conditions. Changes of climate have also been explained by changes in the position of the Japan Current. In the first place, no permanent change of climate is shown by the records, and any slight differences . . . between two winter seasons, or two summer seasons, or different months, can be easily accounted for by irregular variations in the path of the cyclonic storms which pass over the area." R. DEC. WARD.

SOME RESULTS OF RECENT ANTHROPOLOGICAL EXPLORATION IN PERU. Dr. Ales Hrdlička, Curator of the Division of Physical Anthropology, U. S. National Museum, visited the coast of Peru during the summer of 1910 and secured some unlooked-for anthropological results. He examined over thirty ancient cemeteries and collected upwards of 3,400 crania and other skeletal remains. A large part of the crania were free from artificial deformation. His work was confined to the two most important districts on the coast, Pachacamac and Chan-chan or Gran Chimu.

With this material and the collections from Ancon and other places on the Peruvian littoral, it is now possible to learn definitely the physical characteristics of the population of the Peruvian coasts for a distance of over 400 miles, and establish a firm foundation for anthropological comparisons for the rest of the country. From the preliminary examination of the material it may now be positively stated that the whole coast of Peru at least from Pisco to Pacasmayo was peopled by one and the same type of natives, the brachycephalic Indian of moderate stature. The earliest people were followed by others of the same fundamental physical type, but of modified habits shown in part by the pronounced occipital head flattenings which indicate the use of cradle-boards to which the infant was tied for a long period. Belonging to this period are large cemeteries in which the graves yield copper or bronze, with some gold and interesting pottery. The brachycephalic people seem to have been the first inhabitants of the coast, for there was absolutely no trace of any previous occupants, and the peopling of the coast by the brachycephals, judging from the nature and extent of the cemeteries, could not have been of very great duration, not over some centuries before the arrival of the whites.

This old type of the coast people is fundamentally the same as a large portion of the inhabitants of Ecuador, Colombia, Panama, Central America and Yucatan. The present native population was seen by Dr. Hrdlička to show this type as far as the southern confines of the Peru of to-day. Farther southward, however, at Arica and along the Chilean coast, there is an increasingly large proportion of dolichocephalic natives, and from the northern extremity of the central part of the Chilean coast southward this latter type is the only one encountered. (*Smithson. Misc. Coll.*, Vol. 56, 1911, No. 16.)

Atlantic Terminal Docks on the Panama Canal. A plan for terminal facilities at the Atlantic entrance of the Canal has been approved. It consists of a series of five reinforced concrete docks at which ten 1,000-foot vessels, or twenty vessels of the type now in the Isthmian trade, may tie up at one time and take on or discharge cargo. Borings are now being made to determine the nature of the material underlying the water at this place. The estimated cost of the series of five docks is $7,811,666. (*The Canal Record*, Vol. 4, No. 40, 1911.)

Population of Mexico. The census enumeration in Mexico, in October, 1910, gives the Republic a population of 15,063,207, an increase of 10.7 per cent. since the last census, and a density of 8 to the square kilometer.

AFRICA

The Matadi-Leopoldville R.R. This railroad is the sole connecting link between the upper and the lower Congo. The traffic is becoming so large that measures are about to be adopted for improving the line. It has recently been examined by a Belgian engineer with a view to using electricity as the motive power to be derived from the Congo cataracts. Another scheme under consideration and which, it is believed, will soon be adopted, is the laying of a pipe between Matadi and Leopoldville for supplying steamers on the upper river with crude petroleum to take the place of wood fuel. It is proposed, at the same time, to substitute liquid fuel for coal and briquettes on the locomotives. It would thus be possible to accelerate both the railroad and steamer services between the lower Congo and the upper reaches of the river, where wood fuel is becoming scarce at the stopping places. Oil depots would be established along the railroad and the river.

The Madagascar Railroad. The railroad which, for some years has been in operation between Tananarivo, the capital of Madagascar, and Brickaville (169 miles), is being extended from its present eastern terminus at Brickaville to the port of Tamatave, a distance of sixty miles. It is expected that the extension will be completed in 1913, when the capital will be connected by rail with the most important port of the island. (*Bd. of Trade Journ.*, July 6, 1911.)

Cotton Growing in the British Empire. The *Report* of the British Cotton Growing Association for 1910 says that in that year the amount of baled cotton produced in the British colonies was 32,900 bales of 400 lbs. each. The crop of 1908 was 22,300 bales. About three-fourths of the total is produced in the African Colonies, Uganda producing 12,000 bales and the country tributary to Lagos 6,000 bales. Northern Nigeria, which is supposed to be the greatest future reserve in the British colonies of cotton production, yielded only 400 bales. Not until the railroad now building is extended through the large cotton area of that region will the receipts from Northern Nigeria be important.

ASIA

STEAMSHIP SERVICE ON THE AMUR AND SHILKA RIVERS. The Russian Government has empowered the Minister of Ways of Communication to organize, for a period of six years from 1911, a subsidized regular passenger and postal steamship service on the rivers Shilka and Amur between Stretensk on the Shilka and Nicolaievsk at the mouth of the Amur, a distance of about 2,000 miles. The steamship company undertaking this service must guarantee to make not less than thirty-two regular sailings yearly and must maintain not less than seven steamers on the service. (*Board of Trade Journ.*, May 25, 1911.)

EUROPE

POPULATION OF THE AUSTRIA-HUNGARIAN MONARCHY. The census of Dec. 31, 1910, shows a population for the Monarchy of 51,304,249, with a density of 76 to the square kilometer. The population of Austria is 28,567,898; Hungary, 29,840,678; Bosnia-Herzegovina, 1,895,673. The increase in population since the last preceding census of Austria is 9.2 per cent.; of Hungary, 8.34 per cent.

POPULATION OF SPAIN. The population of Spain, according to the census of Dec. 31, 1910, is 19,503,068, including the Canary Islands. The increase in population since the last preceding census was 4.81 per cent. Density, 39 to the square kilometer.

BRITISH CLIMATOLOGY. "The Present Position of British Climatology" formed the subject of the address of Henry Mellish, President of the Royal Meteorological Society, delivered at the meeting of January 18, 1911, and published in the *Quart. Journ. of the Roy. Meteor. Soc.* for April, 1911. At the end of this address there is a bibliography which contains the more important articles on the subject, and which will prove useful to those who are investigating British climatology. R. DEC. WARD.

THE FÖHN WIND AT INNSBRUCK. First-hand descriptions of meteorological phenomena possess obvious advantages over dry, summarized descriptions of the general characteristics of such phenomena. A vivid account of the föhn winds of Innsbruck, by a "resident of Innsbruck," recently published (*Symons's Met. Mag.*, Feb., 1911), emphasizes in a very striking way the relations of this interesting wind to man. So common is the föhn at Innsbruck that it is *the* wind, in the minds of the inhabitants. "Es geht wieder der Wind" is the popular expression when the well-known gusts begin. Windows and doors are then closed to keep out the clouds of dust. Headache, lassitude, depression are the symptoms which many persons experience regularly just before or during the coming of the föhn. Innsbruck has, on the average, forty-three days of föhn, each year, distributed as follows:

JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV	DEC.	YEAR
3.1	3.4	**6.0**	**5.9**	**5.1**	1.5	2.2	1.4	2.0	**4.6**	**4.3**	3.0	42.5

The spring and autumn have the most föhn winds. The numbers of days' duration of these winds, as shown by twenty-five years of observation, are shown in the following table:

Days of föhn.....	1	2	3	4	5	6	7	8
No. of times.....	214	170	61	29	22	5	4	2

Thus, a föhn wind of one day's duration occurred 214 times in twenty-five years, while one of eight days' duration occurred only twice.

An interesting relation to the popularity of Innsbruck as a winter resort is brought out in the fact that the frequent occurrence of this wind in spring is a serious blow to ski-running. While the "Schneefresser" is welcome to the peasants in the high valleys, as melting the snow and moderating the severity of the winter cold, the ski-runner and the skater look upon the föhn with very different eyes. The wind often lasts longest on just those heights where most of the ski-running takes place. The relation of this remarkable wind to vegetation is brought out in the same article. Maize can be raised at Innsbruck because of the moderating influence of these warm winds. A further interesting feature "is the survival in the Inn Valley, near Innsbruck, of floral types from the inter-glacial period, which succeeded the great Ice Age. It is owing to the mild temperature set up by the föhn that these relics of a semi-tropical vegetation have been enabled to continue their existence in their present environment."

R. DEC. WARD.

PACIFIC OCEAN

THE TERRA NOVA AS A SURVEY SHIP. After conveying Capt. Scott and his Antarctic Expedition to their bases of operations in South Victoria Land and King Edward VII Land, the Polar exploring vessel *Terra Nova* returned to New Zealand, where she was chartered by the government for survey work. In July she sailed from Christchurch for the northern coast of North Island and will work between that coast and the Three Kings Islands lying thirty-eight miles northwest of the mainland. These off-shore soundings will be taken to delimit the hundred fathoms line, and shoal soundings will also be made between the islands and the mainland. The results will be of great value to the shipping world, and especially to steamers approaching the North Island from the westward. The work will occupy the *Terra Nova* about three months. In October she will return to Lyttelton to prepare for her next voyage to South Victoria Land. (*London Times,* Weekly Edition, p. 423, 1911.)

FUR SEAL TREATY SIGNED AT WASHINGTON. This treaty between England, Russia, Japan and the United States was signed on July 7, and these countries have now composed their long-existing differences on this subject. The old common-law limitation of three miles from shore is abolished, and no fur seals are to be killed in the North Pacific Ocean, including the seas of Bering, Okhotsk, Kamtchatka and Japan. Provision is made for the maintenance of a patrol of the seal waters by representatives of all the nations concerned. The agreement is to hold for fifteen years, and as long thereafter as no one of the governments denounces it.

PHYSICAL GEOGRAPHY

THE DEEPEST BORING. According to the *Geographische Zeitschrift* (Vol. 7, No. 4, pp. 228-9), the deepest boring yet made is at Czuchow in the Rybnik district of Silesia. It has reached a depth of 7,349 feet beneath the surface. The boring was begun ten years ago, and its diameter near the surface of 1.41 feet was considerable reduced with increasing depth. The temperatures at the various depths are of much interest. At 1,971 feet, the temperature was 82.4° F. From this point to 2,294 feet, the temperature increased very slowly and irregularly. At 3,806 feet, 122° F. was recorded; at 4,156 feet, 140°; at 5,193 feet, 150.8°; at 6,855 feet, 176°. There was an average increase of 1.8° F. in

temperature for every 104 feet of depth attained. At the same rate of increase, the heat at 9,000 feet would be about the boiling point of water. As heat determinations have not been made at greater depths it is, of course, impossible to say what the rate of increase may be below the point attained.

A Layer of Sand Raised Above Water Level by Gases. The formation of an island, due to an unusual cause, is reported in the April number of the *Zeitsch. der Gesells. für Erdk.* of Berlin. On Oct. 23, 1910, an island, 230 by 100 feet in dimensions, appeared on the surface of the Ögel Sea, a small lake near Beeskow in the province of Brandenburg. The investigations of Prof. Potonié, the botanist, showed that it owed its origin to the buoyancy of gases. The lake originally did not drain into the Spree River. Its depth amounted to about 100 feet, which was gradually decreased to 13 feet by the accumulation of decomposed vegetable and calcareous matter. Subsequently a connection was established between the lake and the Spree. This resulted in the deposition of a stratum of sand, which gradually accumulated to such a degree that the gases forming in the mud at the bottom of the lake could no longer escape. The pressure of the gas finally became so great that it was able to raise the layer of sand above the level of the water, thus creating an island. Mud flowed into the void caused by the uplifting of the sand stratum. The island is thus not a floating island, as has been proved by boring.

PERSONAL

Prof. W. M. Davis to be Exchange Professor in Paris. The newly arranged exchange of professors between Harvard University and the Ministry of Public Instruction in France goes into effect this winter for the first time. Prof. Diehl of the Sorbonne comes to Harvard to lecture on Byzantine history; Prof. W. M. Davis of Harvard goes to Paris to lecture on physical geography. This is Prof. Davis' second term of educational service abroad, as in the winter of 1908-09 he was exchange professor at the University of Berlin. His residence there was preceded by an informal international excursion across northern Italy and into southeastern France, attended by professors and students of geography in numbers varying from four to forty or more. A similar excursion for this summer has been arranged in coöperation with Dr. Fr. Nussbaum of Bern, a member of the party in 1908. The excursion will take the form of a "geographical pilgrimage to Rome," beginning in Ireland in late July, continuing with varying membership across England, France and Switzerland, and arriving in Italy in time to take part in such excursions as may be there planned to precede the International Geographical Congress in Rome, Oct. 15-22. Prof. Davis will return from Rome to Paris, and conduct his work at the Sorbonne through the winter semester, Nov. 3 to March 15. His special subject will be the Forms of the Lands, presented in lectures to less advanced students, and in practical exercises to more advanced students.

Prof. H. E. Gregory of Yale University is continuing this summer his study of the water supply and economic resources of the Navajo Reservation for the U. S. Geological Survey. His assistants are Prof. W. R. Barrows and Messrs. K. C. Heald and H. F. Robinson, the latter irrigation engineer of the Indian Service.

Prof. F. W. Sargeson, of the Department of Geology, University of Minnesota, has been appointed geologist on the U. S. Geological Survey. He will complete

the areal, stratigraphic and glacial geology of the Minneapolis, St. Paul, Anoka and White Bear Quadrangles and prepare for publication a folio descriptive of this region.

OBITUARY

PROF. SAMUEL CALVIN. Prof. Calvin, head of the Department of Geology, State University of Iowa, and State Geologist of Iowa, died at Iowa City on April 17. He was 71 years old and had been connected with the university for thirty-seven years.

EDWIN E. HOWELL. Mr. Howell died at his home in Washington on Easter Sunday. He was born on March 12, 1845, in Genesee County, N. Y. For three years he was a geologist of the Wheeler and Powell surveys, making geological reconnaissances in Utah, Nevada, Arizona and New Mexico. The important work by which he is best known was the modelling of relief maps in which he was a pioneer. Many museums and schoolrooms throughout the country have specimens of his plastic representations of physiography, topography and geologic structure.

GENERAL

AERONAUTICS AND CLIMATE. That the development of the art of flying is very closely dependent upon a more accurate knowledge of meteorological conditions is obvious to anyone who stops for a moment to consider the use of aeroplanes and balloons. Some of the best studies of the winds of Germany, recently published, were distinctly undertaken for the purpose of benefiting aerial navigation. The whole matter is one which is certain to attract a rapidly increasing amount of attention. A writer in the New York *Nation* (June 9, 1911), under the title "Problems of the Air," emphasizes the meteorological, and even the larger climatic relations of the aerial navigation of the future. Of the three important basic problems which must be dealt with before aerial navigation can become a well-established art, two are meteorological, *viz.*, a thorough investigation of the behavior of moving "planes" in the air, and the mapping of the air regions over the principal countries of the world, or at least along the principal air lines. The mapping of the air is most essential. Every aviator has had experience with the currents and counter-currents, air walls and precipices. "The men who crossed the English Channel," says Waldemar Kaempffert in his book, "The New Art of Flying," "found that against the chalk cliffs of Dover a vast invisible surf of air beats as furiously as the roaring visible surf in the Channel below." There are, also, some large climatic controls over aviation which the writer of the same article clearly points out. "Natural conditions," he says, "are more favorable to air flight in France than in any other European country. Her more equable climate, her greater amount of sunlight as compared with Germany or England, must be taken into consideration. In the rather random speculation regarding the possibilities of war in the air, little attention has been paid to this advantage which one country may enjoy over another. In England, with its rain and fog, the military air-ship in the future can count only on so many days' activity during the year. In Germany, the range is probably wider. In France it is wider still." R. DEC. WARD.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

(The size of books is given in inches to the nearest half inch.)

AMERICA

Madison: A Model City. By John Nolen. 168 pp., maps and illustrations, Madison Park & Pleasure Drive Association, Boston, 1911. 10½ x 7½.

The title does not mean that the capital of Wisconsin is now a model city, but the purpose is to examine the city as it is with a view to noting its merits, defects and tendencies, and then to suggest a comprehensive programme of definite measures that may be taken to bring about the desired improvements. The author is a "Landscape Architect" of Cambridge, Mass., who was employed by the Directors of the Madison Park and Pleasure Drive Association and a Citizens' Committee of fifty to prepare a plan for the future growth and development of the city. This book is Mr. Nolen's report on present conditions and recommendations for improvement. His suggestions embrace street widening, the securing for public use of the most important of lake frontages, the improvement of railroad approaches, the removal from streets of all wires, poles and other obstructions, systematic planting and maintenance of street trees, reorganization of park work and extension of parks and open spaces, improvement of the housing of persons of small means, and many other features. There are numerous photo-engravings and descriptions of various phases of city improvement at home and abroad which Mr. Nolen believes may be introduced to advantage in Madison. The volume is well worth the study of a much larger public than that for which it was especially prepared.

Argentina and Her People of To-day. An account of the Customs, Characteristics, Amusements, History and Advancement of the Argentinians, and the Development and Resources of their Country. By Nevin O. Winter. xiv and 421 pp., map and illustrations, appendices and index. L. C. Page & Company, Boston, 1911. $3. 8 x 5½.

This would make good enough newspaper travel talk and has a hundred pages of history at the end that are good reading. For the rest it is worth little. The writer has aimed "to present a complete treatise upon the country," but one fears he has not the necessary training. Statements are made so recklessly that no data in the book may be trusted. The author says Argentina has a "half billion acres of fertile arable land," but the Statesman's Yearbook says "253,195,000 acres may be used for agricultural *or cattle industries*" (my italics). "The winter temperature resembles that of the Ohio Valley." Yes: as 55° resembles 35°, unless he is talking of the Straits of Magellan. Of the dry pampa we are told (p. 81) that "water is, however, not far below the

surface." Entirely untrue for vast areas. Argentine "ranks third in wheat." The last Year Book of the United States Department of Agriculture, out when the author wrote, gave the millions of bushels for 1908 as: United States, 737; Russia, 711; France, 356; India, 283; Italy, 165, and Argentina, 162. The International Institute of Agriculture at Rome, for the crop of 1910-11, puts Germany, Spain, Hungary and Canada also above the Argentine Republic; for the previous year all of them but Hungary. Cattle and corn are nearly as much misrepresented. Argentine sheep, he says, would form a solid column of twos all the way from New York to San Francisco! As a matter of fact, they would make a column of twelves! Calle Reconquista (Reconquest Street), reminds us that the British (p. 19) *succeeded* in their attempt to capture the city of Buenos Ayres in 1805. Patagonia was divided, not "a few years ago," but in 1881. The rain of fish (p. 90) in the Chaco doubtless refers to the Lepidosiren buried in the mud through the dry season (*Bulletin*, June, 1911, p. 458). The pictures are well selected. MARK JEFFERSON.

Le Brésil au XX^e^ siècle. Par Pierre Denis. Deuxième Édition. 307 pp. *Librarie Armand Colin, Paris, 1909.* F. 3.50.

The book is much more than a geography (and a first-class one, too) of Brazil; politics and economics are dwelt on as thoroughly as geography, while the relations to geographical conditions are laid open everywhere. For one who wants to learn "all about Brazil" in the shortest and most instructive way, no better book can be imagined. Here are some of the pertinent facts it contains:

Among the young countries of the American continents, Brazil belongs to the comparatively old ones, looking back on a history and traditions of three hundred years of white occupation. This is due principally to the location of northern Brazil in the tropics, which made it one of the countries fit for the production of sugar cane. The plantation system which belongs to that culture developed an aristocratic society of pure Portuguese descent, which, to this day, keeps strictly apart from the laboring classes of colored or mixed blood in a way not common in tropical America. In southern Brazil this distinction is not found, because the temperate climate allowed the settlement by white immigrants from Europe. Among the large cities of Brazil, Rio de Janeiro has, therefore, a character of its own for having been a colonial metropolis long before it became a modern capital.

This difference in the origin of the settlers of the northern and southern states of the republic accounts for some differences in their character and customs. The Portuguese class of the north still hold the larger part of the rural property, and this fact, in a country so preëminently agricultural, means the possession of a large portion of the national wealth and of political influence. That class has preserved the aristocratic, cultured and hospitable traditions of the colonial past, but it has not, on the other hand, remained immune against that influence of rural isolation which tends to produce indifference to matters outside one's immediate sphere of interest. The political and business life is, therefore, much more active in the southern states, where wealth and property are of more recent origin, and where the men of influence belong to the second and third generations.

The lower classes are immigrants everywhere. In São Paulo, the Italians form a fluctuating population of plantation hands in the coffee districts. In the other states of the south the absence of plantations obliged the foreigners to go

out into the wilderness as pioneers of civilization. It is there that they have formed those foreign settlements in which, owing to the isolation of the country, they have preserved their German, Polish and Morbihan-French customs and languages. In the tropical north, it is the descendants of the former slaves who furnish plantation hands in the sugar cane regions, and in the rubber districts season laborers are supplied through an interesting domestic immigration. They are inhabitants of the province of Ceára, a race of Portuguese-Indian half-breeds, who are cowherds in their own country, but, in times of drought, earn their living as harvest hands in the Amazon basin, and thus form a steady supply of labor which, although not African, is used to the climate, and which is never exhausted either, as the Ceãreans are a very prolific race.

Urban populations are found only in Rio, São Paulo, and a few other large cities. Even there they can hardly be called native, as the majority are foreign merchants who live there for the sake of business, and who leave the country as soon as their fortunes are made. The only exception from this rule are the Portuguese, who, speaking the language of the country, are more inclined to found permanent homes there.

Topographically, Brazil consists of three parts: the coast, the plateau country back of it, and the central depression which belongs, in the north, to the Amazon basin, and in the south, to that of the Paraná. The salient feature in the political geography is, that the western boundary includes that depression in the north only, while in the south it runs along the border of the plateau, leaving the basin foreign territory. The escarpment of the plateau on the Atlantic side forms the Serra do Mar and the Serra Ceral. It extends far toward the south, attracting thither, by virtue of its elevation, the equatorial rainfall, which explains that "Serra" is the equivalent of "Forest." The forests are especially favored by the occurrence of a certain kind of diabase soil, so that to a certain degree the geological composition of the soil can be determined from a forest map. Contrary, therefore, to the German word "Wald," which, while meaning forest, is often used to designate a range of mountains, the word "Serra" in Brazil, while originally meaning a range of mountains, is very generally used to designate large tracts of forest. This explains why, on many maps of Brazil, mountain ranges have been found where the real country shows no trace of them; in all these cases it is a wooded country that misled the cartographer, by means of its name, to suppose that a mountain range was there.

The coastal Serras have not, like their seeming counterpart, the Appalachians, acted as a barrier to settlement. For, unlike the coastal plain of North America, that of Brazil is so unhealthy that the colonists could not found any permanent settlements there. They were thus obliged to penetrate into the hinterland at an early date, so that the plateau was opened up much more rapidly than the coast. The visitor from abroad is very much mistaken when, on arriving at the coast, and seeing the skyline of, as it were, virgin forest, which rises back of the coastal plain, he supposes that Brazil ends there. For the real Brazil only begins back of the Sierra, because the plateau contains the larger, as well as the most stable part of the population, while that of the coast is foreign and fluctuating.

Aside from its commercial function, the coast also acts as a highway between the different provinces, for the rivers of Brazil, in spite of their large sizes, are navigable only on certain reaches, and Porto Allegre, on the Rio Grande, is about the only place where a couple of navigable waterways converge. This

fact must not be overlooked when considering the prosperity of the German colonies in that neighborhood.

The country roads of Brazil are as poor as they are old, and some of them are very old. They would not be recognizable to-day were it not for the alignment along their former courses of farms and hamlets whose existence would be unintelligible to one not knowing that once upon a time a road was running by there. The doom of the roads was caused by the railroads because, as soon as the government began to build the latter, it ceased to take care of the former. The monopoly of the railroads in Brazil is, therefore, as complete as it is in the American West, and it has produced the same rate and tariff conditions as on the northern continent.

The most conspicuous feature in the recent development of Brazil is the shifting of economical leadership from the tropical to the temperate states, from Bahia and Pernambuco to São Paulo, from sugar and rubber to coffee. In this process, too, geographical influences have been at work. It is the above-named diabases whose detritus produces the "violet" soil especially suited for coffee, and the State of São Paulo is fortunate enough to possess plenty of that soil. There was a period in the early history of the state in which the hunt for violet soil was as lively as was the hunt for gold in the Far West. At that time—soon after the Civil War—a strong immigration set in, not only from Europe, but also from the United States, and many Southerners who had lost everything in the war, tried to begin life over again on the violet soil. By the side of Nova Fribourg and Nova Helvetia, Villa America has remained as a permanent witness of that period.

The present prosperous condition of that state ought, however, to be safeguarded against two imminent dangers: first, the exclusive devotion to one product, and a product for exportation only; for coffee is king in São Paulo, as cotton was in the old South. Secondly, the impossibility for the small property to hold its own against the overwhelming influence of the large land-owners. In the more southern states where coffee does not reign supreme, the small property dominates, and the foreign colonies of those states produce everything they need, and would be able even to export a large part of their abundance if there were only good markets for their products, or convenient connections with such markets at their disposal. M. K. GENTHE.

AFRICA

Siwah. Die Oase des Sonnengottes in der libyschen Wüste. Von J. C. Ewald Falls. 48 pp. and 25 illustrations. Verlag von Kircheim & Co., Mainz, 1910. Mk. 2. 10½ x 7½.

This is the latest of three reports on the Siwa Oasis published within the past four years. *It does not attempt to compare with the two preceding studies* in thorough scientific treatment. The Khedive of Egypt five years ago crossed the Libyan waste as far as the Siwa Oasis, the first ruler to make this journey since Alexander the Great in 332 B. C. Mr. Falls, a German scholar, participated in the expedition and has written for the general public this account of the journey and description of the famous Oasis of Jupiter Ammon. His first chapter is given to the Khedival caravan route, which largely coincided with that of Alexander the Great. In the second chapter he describes the oasis and its culture, its industries, commerce, flora and fauna. The town of Siwa and its widespread monuments of earlier days are sketched in the third chapter,

and he concludes with a brief account of the geology of the region. Incidentally, he throws some interesting light on the characteristics of the Khedive, who is certainly to be admired for his earnest efforts to see for himself some of the more remote parts of his land. The illustrations are admirable and instructive, but there is no map.

NEW MAPS

EDITED BY THE ASSISTANT EDITOR

MAPS ISSUED BY UNITED STATES GOVERNMENT BUREAUS

U. S. GEOLOGICAL SURVEY

TOPOGRAPHIC SHEETS:

Alaska. Reconnaissance Map of Yukon-Tanana Region, Alaska. Circle Quadrangle. Alaska Sheet No. 641. 1:250,000 (1 in.=3.95 miles). (66° - 64° N.; 146° - 142° W.). Contour interval 200 ft. Datum is mean sea level, assuming an elevation of 810 ft. at Eagle. Surveyed in 1903, 1904, 1905 and 1908. Edition of May 1911. [Delineation of topography in the N. E. corner of the sheet does not extend beyond the Yukon.]

Arizona-California. Parker Quadrangle. 1:125,000 (1 in.=1.97 mile). (34°30′ - 34°0′ N.; 114°30′ - 114°0′ W.). Interval 50 ft. Surveyed in 1902-03 and 1909. Edit. of March 1911.

Illinois. Hennepin Quad. 1:62,500 (1 in.=0.99 mile). (41°30′ - 41°15′ N.; 89°30′ - 89°15′ W.). Interval 20 ft. Surveyed in 1909. Edit. of April 1911.

Kentucky. Dawson Springs Quad. 1:62,500. (37°15′ - 37°0′ W.; 87°45′ - 87°30′ W.). Surveyed in 1909. Edit. of May 1911.

Maryland. Prince Frederick Quad. 1:62,500. (38°45′ - 38°30′ N.; 76°45′ - 76°30′ W.). Interval 20 ft. Surveyed in 1890, revised in 1900 and 1904-05. Edit. of May 1910.

Maryland-Pennsylvania. Emmetsburg Quad. 1:62,500. (39°45′ - 39°30′ N.; 77°30′ - 77°15′ W.). Interval 20 ft. Surveyed in 1908-09. Edit. of March 1911. [Names of townships printed from type.]

Maryland-Pennsylvania. Taneytown Quad. 1:62,500. (39°45′ - 39°30′ N.; 77°15′ - 77°0′ W.). Interval 20 ft. Surveyed in 1908-09. Edit. of Feb. 1911. [Names of townships printed from type.]

Michigan. Calumet Special Map. 1:62,500. (47°26′ - 47°7′ N.; 88°37′ - 88°18′ W.) Interval 20 ft. Surveyed in 1908-09. Edit. of May 1911.

New York. Monticello Quad. 1:62,500. (41°45′ - 41°30′ N.; 74°45′ - 74°30′ W.). Interval 20 ft. Surveyed in 1908-09. Edit. of May 1911.

Virginia-Tennessee-North Carolina. Abingdon Quad. 1:125,000. (37°0′ - 36°30′ N.; 81°45′ - 81°30′ W.). Interval 50 ft. Surveyed in 1908-09. Edit. of April 1911. [Names of counties printed from type.]

West Virginia. Peytona Quad. 1:62,500. (38°15′ - 38°0′ N.; 81°45′ - 81°30′ W.) Interval 50 ft. Surveyed in 1908-09. Edit. of April 1911. [Names of counties printed from type.]

Maps in U. S. G. S. Bulletins

ALABAMA. Map and Sections of the Southern Part of Cahaba Coal Field, Alabama. By Charles Butts. Scale of map and of sections 1:114,000 (1 in.=1.80 mile). 33°14′ - 33°0′ N.; 87°15′ - 86°53′ W.) Black. With inset showing general location. Accompanies, as Pl. IV, *Bull.* 431, 1911.

ALASKA. [Five maps accompanying "A Geologic Reconnaissance in Southeastern Seward Peninsula and the Norton Bay-Nulato Region" by P. S. Smith and H. M. Eakin, *Bull.* 449, 1911:]

(a) Reconnaissance Map of Southwestern Seward Peninsula, Alaska. 1:250,000 (1 in.=3.95 miles). (65°32′ - 64°20′ N.; 164°0′ - 164°40′ W.). Surveyed in 1900, 1903 and 1909. 2 colors. Pl. I. [Relief in brown contours, interval 200 ft.; drainage in blue; culture in black.]

(b) Geologic Map of Southeastern Seward Peninsula, Alaska. 1:250,000. 11 colors. Pl. VI. [Geology superimposed on map (a) as a base. Distinguishes between: A. Sedimentary rocks: I Non-metamorphic (2 subdivisions); II Metamorphic (2 subdivisions). B. Igneous rocks: I Non-metamorphic (3 subdivisions); II Metamorphic (1 subdivision).]

(c) Geologic Map of Nulato-Norton Bay Region, Alaska. 1:500,000 (1 in.= 7.89 miles). (65°32′ - 64°0′ N.; 162° - 155½° W.) 12 colors. Pl. V. [Relief in sketch contours, interval 400 ft. Geological subdivisions as on map (b), except for non-metamorphic igneous rocks, which comprise 4 subdivisions.]

(d) Map Showing Distribution of Timber. [1:1,360,000 (1 in.=21½ miles approx.).] (65°30′ - 64°8′ N.; 164° - 157° W.). Black. Pl. IV. [Timbered areas shown in stippling.]

(e) Geologic Map of Omilak Region. [1 in.=2 miles (1:126,120).] (65°8′ - 64°54′ N.; 162°40′ - 162°20′ W.) Black. Pl. VII.

ARIZONA. Map of the Black Mesa Coal Field, Arizona. By M. R. Campbell. 1:500,000 (1 in.=7.89 miles). (36°42′ - 36°30′ N.; 111°25′ - 109°32′ W.). Black. With inset showing general location. Accompanies, as Pl. XI, *Bull.* 431, 1911.

ARIZONA. Map of the Pinedale Coal Field, Navajo Co., Arizona. By A. C. Veatch. [1:46,000 approx. (1 in.=0.7 mile approx.).] (About 34°18′ N. and 110°25′ W.) Black. With inset showing general location. Accompanies, as Pl. XII, *Bull.* 431, 1911.

MONTANA. (a) Map of the Northeastern Part of the Bull Mountain Coal Feild, Montana. By C. T. Lupton and H. Hinds. 1:63,360. (1 in.=1 mile). (46°36′ - 46°24′ N.; 108°15′ - 107°45′ W.). Black. (b) Map of the Southeastern Part of the Bull Mountain Coal Field, Montana. By C. T. Lupton and H. Hinds. 1:63,360. (46°24′ - 46°8′ N.; 108°2′ - 107°47′ W.). Black. Accompany, as Pls. VI and VII, *Bull.* 431, 1911.

NORTH DAKOTA. Map of North Dakota Showing Location of Gas Wells. [1:2,600,000 approx. (1 in.=41 miles approx.).]. (49° - 46° N.; 104° - 96½° W.). Black. Accompanies, as Pl. I, *Bull.* 431, 1911.

OREGON. (a) Map of the Coos Bay Coal Field, Oregon. By J. S. Diller and M. A. Pishel. [1:200,000 approx. (1 in.=3.2 miles approx.).]. (43°26′ - 43°2′ N.; 124°27′ - 124°7′ W.). (b) Map of the Northern Part of the Coos Bay Coal Field, Oregon. By J. S. Diller and M. A. Pishel. 1:63,360 (1 in.=1 mile). (43°26′ - 43°21′ N.; 124°20′ - 124°6′ W.) Black. (c) Map of the Middle Part of the Coos Bay Coal Field, Oregon. By J. S. Diller and M. A. Pishel. 1:63,360 (43°21′ - 43°16′ N.; 124°24′ - 124°6′ W.). Black. (d) Map of T[ownship] 27 S., R[ange] 13 W., Coos Bay Coal Field, Oregon. By J. S. Diller and M. A. Pishel. 1:63,360 (43°16′ - 43°11′ N.; 124°18′ - 124°10′ W.). Black. Accompany, as Fig. 4 (p. 199) and Plates VIII, IX and X, *Bull.* 431, 1911.

OREGON-IDAHO. Reconnaissance Sketch Map of the Prospective Gas and Oil Fields near Vale, Ore., and Payette, Idaho. 1:250,000 (1 in.=3.95 miles). (44°20′ - 43°45′ N.; 117°30′ - 116°50′ W.). Black. With inset showing general location. Accompanies, as Pl. III, *Bull* 431, 1911. [Township and range lines only. Distinguishes between basalt and rhyolite and Payette and Idaho formations. Gives locations of prospect oil wells, gas wells, of anticlinal and synclinal axes, of faults. Wagon roads shown. On inset map course of lower Salmon R. is taken from obsolete maps, although the U. S. G. S. standard base map gives it correctly.]

UTAH. Map of San Juan Oil Field, Utah. Based on map by E. E. Miller. 1:250,000 (1 in.=3.95 miles). (37°26′ - 37°0′ N.; 110°5′ - 109°33′ W.). Black. With inset showing general location. Accompanies, as Pl. II, *Bull.* 431, 1911. [No geographic coordinates; township and range lines only. Gives location of anticlines and of oil seeps. Shows areas within which drilling has been done. Wagon roads shown.]

VIRGINIA. Sketch Map of the Powell Mountain Coal Field, Virginia. [1 in.= 2 miles (1:126,720).] (36°51′ - 36°35′ N.; 80°38′ - 80°13′ W.). Black. With inset showing general location. Accompanies, as Pl. V, *Bull.* 431, 1911. [Shows faults, coal mines and coal prospects.]

General

OREGON-WASHINGTON. Index [Map] to Atlas Sheets. Oregon, Washington. 1:2,500,000 (1 in.=39.46 miles). Extract from U. S. G. S. Base Map. Edition of May 1, 1911. On reverse, list of special maps and of geologic folios of Ore. and Wash., of maps of the U. S., and names and addresses of local agents for topographic maps. Accompanied by list of geologic reports relating to this region which are not parts of the topographic or geologic atlas. [Distinguishes between: (1) topographic field work completed; sheets in course of publication, (2) topographic sheets published, (3) topographic sheets and geologic folios published, (4) maps of same region on two scales.]

U. S. COAST AND GEODETIC SURVEY

Atlantic Coast

North Shore of Long Island Sound. Blackstone Rocks to South End, Including Brandford Harbor, Connecticut. 1:10,000 (1 in.=0.16 mile). (41°17.6′-41°12.5′ N.; 72°53′-70°47′ W.). Chart No. 261. May 1911. 50 cents. [Relief in contours; interval 20 ft.]

New Haven Harbor, Connecticut. 1:20,000 (1 in.=0.32 mile). (41°20.1′-41°10.3′ N.; 73°0′-72°51′ W.). Chart No. 362. May 1911. 20 cts. [Relief in contours; interval 20 ft.]

Jamaica Bay and Rockaway Inlet, Long Island, New York. 1:20,000. (40°39.4′-40°31.8′ N.; 73°57.0′-73°44.2′ W.). Chart No. 542. April 1911. 50 cts.

Philadelphia Water Front, Schuylkill River, Pennsylvania. 1:9,600 (1 in.=0.13 mile). (39°58.8′-39°52.3′ N.; 75°13.8′-75°9.5′ W.). Chart No. 381. April 1911. 50 cts.

Rappahannock River. Marsh Point to Fredericksburg. Chesapeake Bay, Virginia. 1:20,000. (38°15.9′-38°7.4′ N.; 77°19.2′-77°5.2′ W.). From Marsh Point to Mill Reach on main map; from Mill Reach to Fredericksburg (38°14.0′-38°18.7′ N.) on inset. Chart No. 536. May 1911. 50 cts.

Gulf Coast

Point au Fer to Marsh Island, Louisiana. 1:80,000 (1 in.=1.26 mile). (29°51′-29°4′ N.; 91°49′-91°8′ W.). Chart No. 199. May 1911. 50 cts.

San Luis Pass to Matagorda Bay. 1:80,000. (29°7′-28°34′ N.; 95°59′-94°3′ W.) Chart No. 1281. May 1911. 50 cts.

West Indies and Panama

Colon Harbor, Panama. 1:15,000 (1 in.=0.23 mile). (9°25.3′-9°18.3′ N.; 79°58.3′-79°52.7′ W.) Chart No. 950. May 1911. 50 cents.

Pacific Coast

Santa Rosa Island to Point Buchon, California. 1:200,000 (1 in.=3.16 miles). [Oriented N. 18° E.] (35°20′-33°40′ N.; 121°20′-120°0′ W.) Chart No. 5300. May 1911. 50 cts.

San Francisco, Southern Part, California. 1:50,000 (1 in.=0.79 mile). (37°49.0′-37°24.5′ N.; 123°24.5′-121°57.0′ W.) Chart No. 5531. May 1911. 50 cts. [Relief in contours; interval 20 ft.]

Mare Island Strait, California. 1:20,000. (38°7.6′-38°2.9′ N.; 122°17.4′-122°13.6′ W.) Chart No. 5525. May 1911. 20 cts.

Cape Flattery to Dixon Entrance, Northwest Coast of [North] America. [Mercator projection: equatorial scale 1:1,800,000 approx.] (54°50′-47°35′ N.; 138°-123° W.) Chart No. 7002. May 1911. 50 cts.

Pacific Ocean—Philippine Islands

Anchorage, Verde Island Passage to Cuyo, Philippine Islands. [7 charts, viz.:] (1) Looc Bay, Lubang Island. 1:25,000 (1 in.=0.39 mile). (13°44′ N.; 120°17′ E.) (2) Sablayan Anchorage, West Coast of Mindoro. 1:10,000. (12°50′ N.; 120°45′ E.) (3) Paluan Bay, West Coast of Mindoro. 1:60,000 (1 in.=0.94 mile). (13°23½′ N.; 120°29′ E.) (4) Cuyo Anchorage, Cuyos Islands. 1:150,000 (1 in.=2.36 miles). (10°51′ N.; 121°0′ E.) (5) Port Tilig,

North Coast of Lubang. 1:35,000 (1 in.=0.55 mile). (13°49′ N.; 120°11′ E.) (6) Port Culion, Culion Island. 1:30,000 (1 in.=0.47 mile). (11°54′ N.; 120°1′ E.) (7) Coron and Port Uson, South Coast of Busuanga. 1:40,000 (1 in.= 0.63 mile). (12°2′ N.; 120°13′ E.) Chart No. 4345. May 1911. 30 cts.

Harbors in Negros and Vicinity, Philippine Islands. [9 charts, viz.:] (1) Dumaguette, Southeast Coast of Negros. 1:10,000. (9°18½′ N.; 123°18½′ E.) (2) Himugaan River, North Coast of Negros. 1:15,000. (10°57′ N.; 123°24′ E.) (3) Calagcalag Bay, East Coast of Negros. 1:10,000. (9°50′ N.; 123°8½′ E.) (4) Refugio Pass, East Coast of Negros. 1:35,000. (10°28′ N.; 123°25′ E.) (5) Bais, East Coast of Negros. 1:30,000. (9°36′ N.; 123°9′ E.) (6) Port Canoan, Siquijor Island. 1:5,000 (1 in.=0.08 mile). (9°15′ N.; 123°35½′ E.) (7) Port Bombonon, South Coast of Negros. 1:10,000. (9°3′ N.; 123°7′ E.) (8) Port Siyt, South Coast of Negros. 1:10,000. (9°4′ N.; 123°9′ E.) (9) Himamaylan, West Coast of Negros. 1:20,000. (10°5′ N.; 123°52′ E.) Chart No. 4466. May 1911. 30 cts.

Hydrographic Office

Pilot Chart of the North Atlantic Ocean. July 1911. [Mercator projection: equatorial scale 1:15,900,000 approx.] (60° N.-0°; 102° W.-10° E.) With two insets showing (a) distribution of average number of days with gales in July and (b) isotherms, isobars, and isogonic lines for July. 3 colors. On reverse: [Map of] The Gulf Stream in the Gulf of Mexico Showing the Currents as they Exist During the Different Seasons. By Lieut. J. C. Soley, U. S. N. [Mercator projection: equatorial scale 1:4,350,000 approx.] (30½° - 18° N.; 98° - 77° W.) Reprinted from Pilot Chart of North Atlantic Ocean of March 1909.

U. S. Weather Bureau

Meteorological Chart of the North Atlantic Ocean. a. July, b. August 1911. [Mercator projection: equatorial scale 1:15,000,000 approx.] (60° N.-0°; 102° W. - 10° E.) 5 colors. On reverse two maps, with notes, showing water surface temperatures, air temperatures and currents, for July, of (a) North Atlantic Ocean. [Mercator projection: equatorial scale, 1:37,500,000 approx.] (60° N.-0°; 100° W.-0°.) 1 color; (b) North Pacific Ocean. [Mercator projection: equatorial scale, 1:60,000,000 approx.] (70° N. - 0°; 114° E. - 76° W.) 1 color.

Meteorological Chart of the North Pacific Ocean. a. July, b. August 1911. [Mercator projection: equatorial scale, 1:30,000,000 approx.] (70° N. - 0°; 114° E. - 76° W.) 6 colors. On reverse, maps with notes as on Chart of North Atlantic Ocean.

Meteorological Chart of the Indian Ocean. a. July, b. August 1911. [Mercator projection: equatorial scale, 1:22,700,000 approx.] (30° N.-50° S.; 10°-140° E.) 4 colors.

Meteorological Chart of the Great Lakes. a. July, b. August 1911. [Mercator projection: equatorial scale, 1:2,800,000 approx.] (49° - 41¼° N.; 92¼° - 76° W.) 6 colors. On reverse, table of wind velocities and lists of wireless telegraph stations and submarine signal-bell stations.

War Department

Porto Rico. (a) Road and Railroad Map of Porto Rico, June 30, 1910. [1:575,000 approx. (1 in.=9 miles approx.)] Black. (b) Map [of Porto Rico] Showing Telegraph and Telephone Lines in Operation by Insular Government, June 30, 1910. [1:580,000 approx. (1 in.=9 miles approx.)] Black. Accompany, facing p. 124, Appendix III, Tenth Annual Report of the Governor of Porto Rico, in *Annual Report*, War Dept., 1910, Vol. IV, 1911.

Bureau of American Ethnology

Arizona. Sketch Map of the Navaho National Monument from Official Reports by W. B. Douglass. U. S. Gen'l. Land Office. 1910. [1:345,000 approx. (1 in.=5 miles approx.)] (37°6′ - 36°30′ N.; 110°0′ - 110°15′ W.) Accompanies, as Pl. 22, "Preliminary Report on a Visit to the Navaho National Monument, Arizona," by J. W. Fewkes, *Bull.* 50, Bureau of Amer. Ethnol. 1911. [Shows location of pre-historic ruins of northern Arizona.]

UNITED STATES. Indian Tribes of the Lower Mississippi and Adjacent Gulf Coast by John R. Swanton. 1909. [1:3,500,000 approx. (1 in.=55 miles approx.).] (34 2/3° - 28 1/2° N.; 95° - 84° W.) 7 colors. Accompanies, as Pl. I, treatise with similar title by same author, *Bull.* 43, Bureau of Amer. Ethnol., 1911. [Distinguishes between following linguistic families: Caddoan, Siouan, Muskhogean (a) proper, (b) of the Natchez group, Tunican, Chitimachan, Atakapan.]

NORTH AMERICA

CANADA. Map of Abitibi Region Indicating the Surveyed Townships Traversed by the Transcontinental and Those Projected Lying to the South of this Line of Railway. [1 in.=4 miles (1:253,440).] (51°40′ - 47°20′ N.; 79°45′ - 76°45′ W.) 1 color. Two sheets. Dept. of Lands and Forests, Quebec. Jan. 4, 1911. [Valuable large scale map of the region between Lake Temiscaming and James Bay. Relief not shown.]

CANADA. Vicinity of the National Transcontinental Railway. Abitibi District, Quebec. Map 12 A. Areal Geology, Exploratory, Quebec. 1:253,440, or 4 miles to 1 inch. (48°53′ - 48°0′ N.; 79°34′ - 75°23′ W.) 3 colors. With inset showing general location of main map. Accompanies, as No. 1112, Geol. Surv. of Canada, "Geological Reconnaissance Along the Line of the National Transcontinental Railway in Western Quebec," by W. J. Wilson, *Memoir* No. 4, Publ. No. 1110, Geol. Surv. of Canada, 1910. [Distinguishes between Keewatin, Laurentian and Drift. Indicates glacial striae.]

CANADA. (a) Outline [Map] of Part of Southern Ontario showing localities where the altitudes of the Algonquin and Nipissing shore lines have been measured; the height of the Algonquin shore line in feet above sea-level at each place; isobases, hinge-line and line of direction of maximum inclination of the Algonquin water plane. [1 in.=12 miles (1:760,320).] [Oriented N. 21° W.] (Includes Interlake Peninsula of Ontario W. of Pigeon Lake except southern part.) With "Profile of Warped Water Planes along Lines A-B, C-D [on map]," [horizontal scale 1:560,000 approx.; vertical exaggeration 500 times]. Black. (b) Diagram Showing Present Attiude of the Algonquin Water Plane (alternative title in text: General Map of the Great Lake Region Showing Isobases of the Algonquin Beach). [1:4,700,000 approx. (1 in.=74 miles approx.)] (46°40′ - 41°50′ N.; 89°0′ - 78°15′ W.) Black. (c) Diagram Showing Present Attitude of the Nipissing Water Plane (alternative title in text: General Map of the Great Lake Region Showing Isobases of the Nipissing Beach). Black. Accompany, as Figs. 1, 2 (profile), 3 and 4, "An Instrumental Survey of the Shorelines of the Extinct Lakes Algonquin and Nipissing in Southwestern Ontario" by J. W. Goldthwait, *Memoir* No. 10, Publ. No. 1137, Geol. Surv. of Canada, 1910. ['Isobases' referred to are lines of present equal deformation of the shore line of the glacial lakes Algonquin and Nipissing.]

CANADA. Outline Sketch of the Northern Part of Purcell Range, British Columbia, from Provincial Mining Maps. 1:1,000,000 (1 in.=15.78 miles). (51°33′ - 49°50′ N.; 118°20′ - 115°20′ W.) With inset, 1:10,000,000, showing location of main map. 1 color. Accompanies "Across the Purcell Range of British Columbia," by T. G. Longstaff, *Geogr. Journ.*, Vol. 37, pp. 589-600, 1911. [Shows route of Dr. Longstaff and of Mr. A. O. Wheeler from Howser Lake up Howser Creek, over Bugaboo Pass (7,160 ft.) and down Bugaboo R. to Columbia R.]

CANADA. (a) Carte Régionale No. 2 de la Province de Québec comprenant les Comtés de St. Maurice, Maskinonge, Berthier, Joliette, Montcalm, L'Assomption, Jacques-Cartier, Hochelaga, Laval, Terrebonne, Soulanges, Vaudreuil, Deux Montagnes, Argenteuil et Ottawa. Dressée par A. M. Taché. 1:253,440 (1 in.= 4 miles). (46°55′ - 45°10′ N.; 76°10′ - 72°30′ W.) 3 colors. Dépt. des Terres et Forêts, Québec. Jan. 1911. (b) Carte Régionale No. 6 de la Province de Québec, comprenant les Comtés de Témiscouata, Kamouraska, L'Islet, Montmagny, Bellechasse, Lévis, et Partie de ceux de Beauce, Lotbinière et Mégantic. Dressée par A. M. Taché. [1 in.=4 miles (1:253,440).] [Oriented N. 22½° E.] (Embraces valley of St. Lawrence from Lotbinière to mouth of Saguenay and all

of Province of Quebec on right bank from Lake Megantic to Lake Temiscouata.) 3 colors. Dépt. des Terres et Forêts, Québec. Feb. 1908. [On both maps no relief. Subdivisions of counties shown.]

CANADA. La Vallée du Lac Saint-Jean. Echelle: 12 milles au pouce (1:760,320). (49°7′-48°0′ N.; 72°55′-71°0′ W.) 5 colors. Accompanies "Chicoutimi et Lac St.-Jean" by E. Rouillard, *Bull. de la Soc. de Géogr. de Québec*, Vol. 5, (1911), pp. 157-184. [Shows public roads and railroads and boat lines on Lake St. John. Parishes politically colored. No relief.]

MEXICO. Outline Map of Lower California. From the Bureau of American Republics. With Corrections and Additions by E. W. Nelson. [1:7,200,000 approx. (1 in.=114 miles approx.)] (33°-22° N.; 117½°-108° W.) Black. Accompanies, on p. 446, "A Land of Drought and Desert—Lower California" by E. W. Nelson, *Natl. Geogr. Mag.*, Vol. 22, pp. 443-474, 1911. [Wagon roads and author's route shown.]

MEXICO. The National Geographic Magazine Map of Mexico. Prepared by J. G. Bartholomew. G. H. Grosvenor, Editor. The Edinburgh Geographical Institute: John Bartholomew & Co. 1:5,000,000 (1 in.=78.91 miles). (31°-15° N.; 117°-86° W.) 5 colors. Supplement to *Natl. Geogr. Mag.*, Vol. 22, No. 5 (May 1911). [A hypsometric map showing in five shades of brown the areas lying between the contours of 0, 500, 2,000, 5,000 and 8,000 ft. and above 8,000 ft. Additional contours not brought out by tints, one each between 0 and 500 ft. and 500 and 2,000 ft., two between 2,000 and 5,000 ft., one between 5,000 and 8,000 ft. and one above 8,000 ft. A map, in compilation and execution, of the usual excellence of the products of the Edinburgh Geographical Institute.]

MEXICO. Croquis Anexo al Informe acerca de una Exploracion en el Estado de Yucatan. 1:934,340 (1 in.=14.75 miles). (22°-19⅘° N.; 91°-87° W.) Black. Accompanies, as Pl. 53, paper with similar title by J. Engerrand and F. Urbina, *Pareng. del Inst. Geol. de Mexico*, Vol. 3, pp. 371-424, 1910. [Outline map showing route of expedition.]

CENTRAL AMERICA

CENTRAL AMERICA. État actual des voies ferrées dans l'Amérique centrale. 1:10,000,000 (1 in.=157.83 miles). (19°-7° N.; 92½°-78° W.) Black. Accompanies, as Fig. 1 on p. 263, "Les Voies de Communication dans l'Amérique Centrale" by M. de Périgny, *Ann. de Géogr.*, Vol. 20, pp. 260-262, 1911. [Shows existing railroads and some steamship routes.]

SOUTH AMERICA

BRAZIL. Republica dos Estados Unidos do Brazil. [1:20,000,000 (1 in.=315.66 miles).] Black. Accompanies, facing p. 330, paper on "Les Limites Actuelles du Brésil par Suite des Derniers Arbitrages et Traités" by de O. Lima, *Compte Rendu*, IXème Congr. Intern. de Géogr., Tome III, pp. 327-333, Geneva, 1911. [Outline only. Of value because of Portuguese nomenclature. Boundaries indicated according to latest treaties.]

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